PRICE $2.00

Bob Kelley

Assembling and Using Your...

Heathkit

TRANSISTOR INTERCOM MASTER STATION AND REMOTE STATION

MODELS XI-1 AND XIR-1

HEATH COMPANY

A Subsidiary of Daystrom Inc.

BENTON HARBOR, MICHIGAN

595-284

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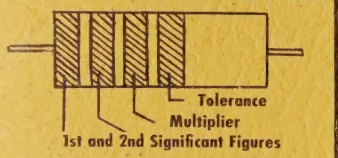
Heath Company

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

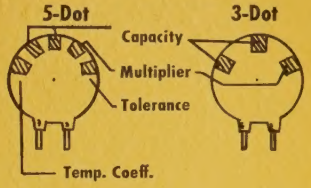
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR

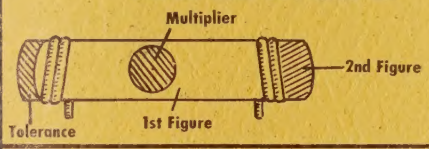


Wire wound resistors have 1st digit band double width

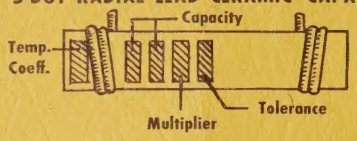
DISC CERAMIC RMA CODE



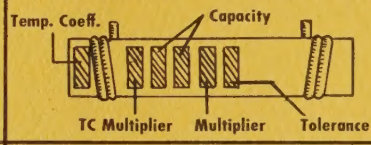
RADIAL LEAD DOT RESISTOR



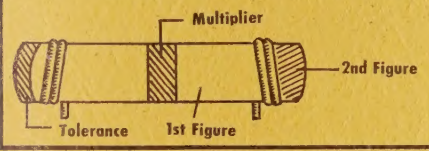
5-DOT RADIAL LEAD CERAMIC CAPACITOR



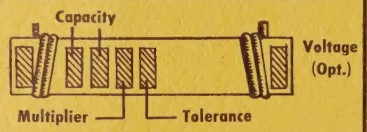
EXTENDED RANGE TC CERAMIC HICAP



RADIAL LEAD (BAND) RESISTOR



BY-PASS COUPLING CERAMIC CAPACITOR



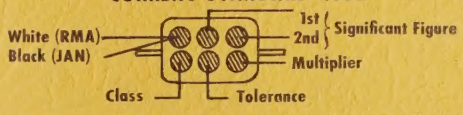
AXIAL LEAD CERAMIC CAPACITOR

The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

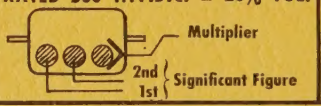
MOLDED MICA TYPE CAPACITORS

CURRENT STANDARD CODE

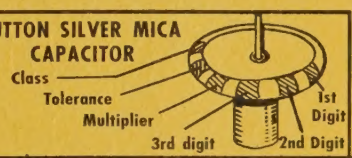


JAN & 1948 RMA CODE

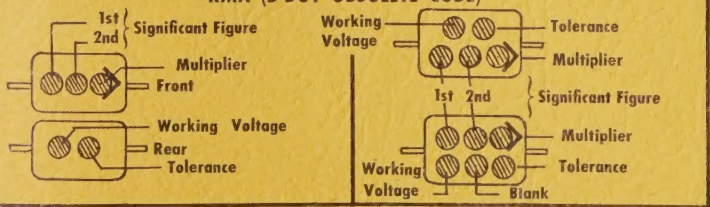
RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.



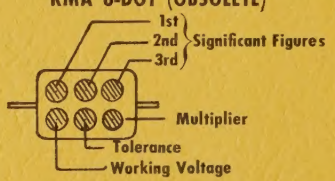
BUTTON SILVER MICA CAPACITOR



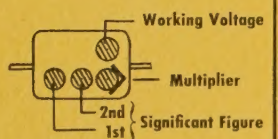
RMA (5-DOT OBSOLETE CODE)



RMA 6-DOT (OBSOLETE)

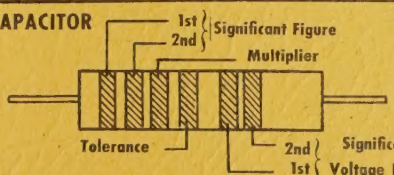


RMA 4-DOT (OBSOLETE)



MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR

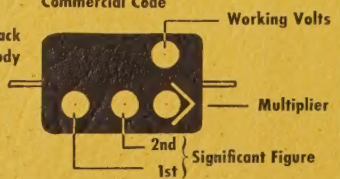


Normally stamped for value

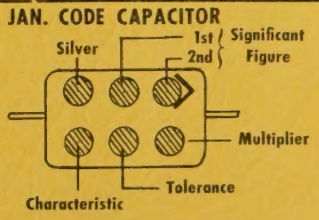
A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

MOLDED FLAT CAPACITOR

Commercial Code



JAN. CODE CAPACITOR



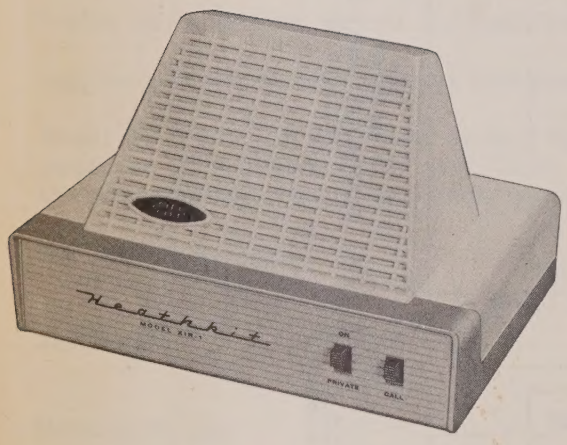
The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

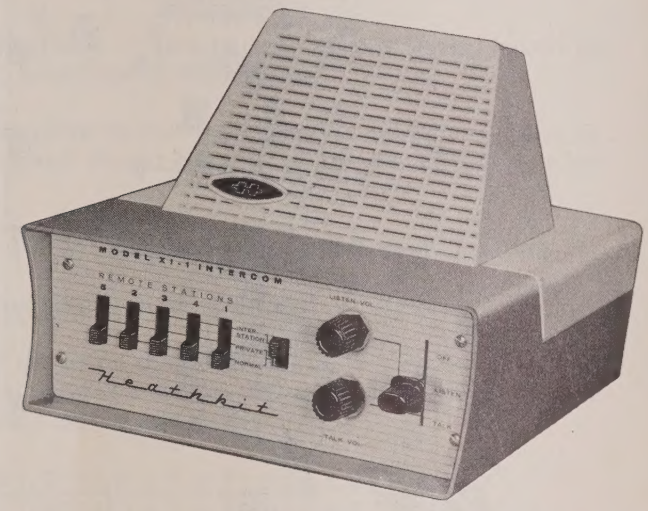
In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

ASSEMBLY AND OPERATION OF THE HEATHKIT TRANSISTOR INTERCOM MASTER STATION AND REMOTE STATION

MODELS XI-1 AND XIR-1





SPECIFICATIONS

One XI-1 Master Station operates with from one to five XIR-1 Remote Stations.

Selective-call or all-call switching.

Any station can originate a call.

3-stage transistor amplifier utilizing four 2N1274 transistors.

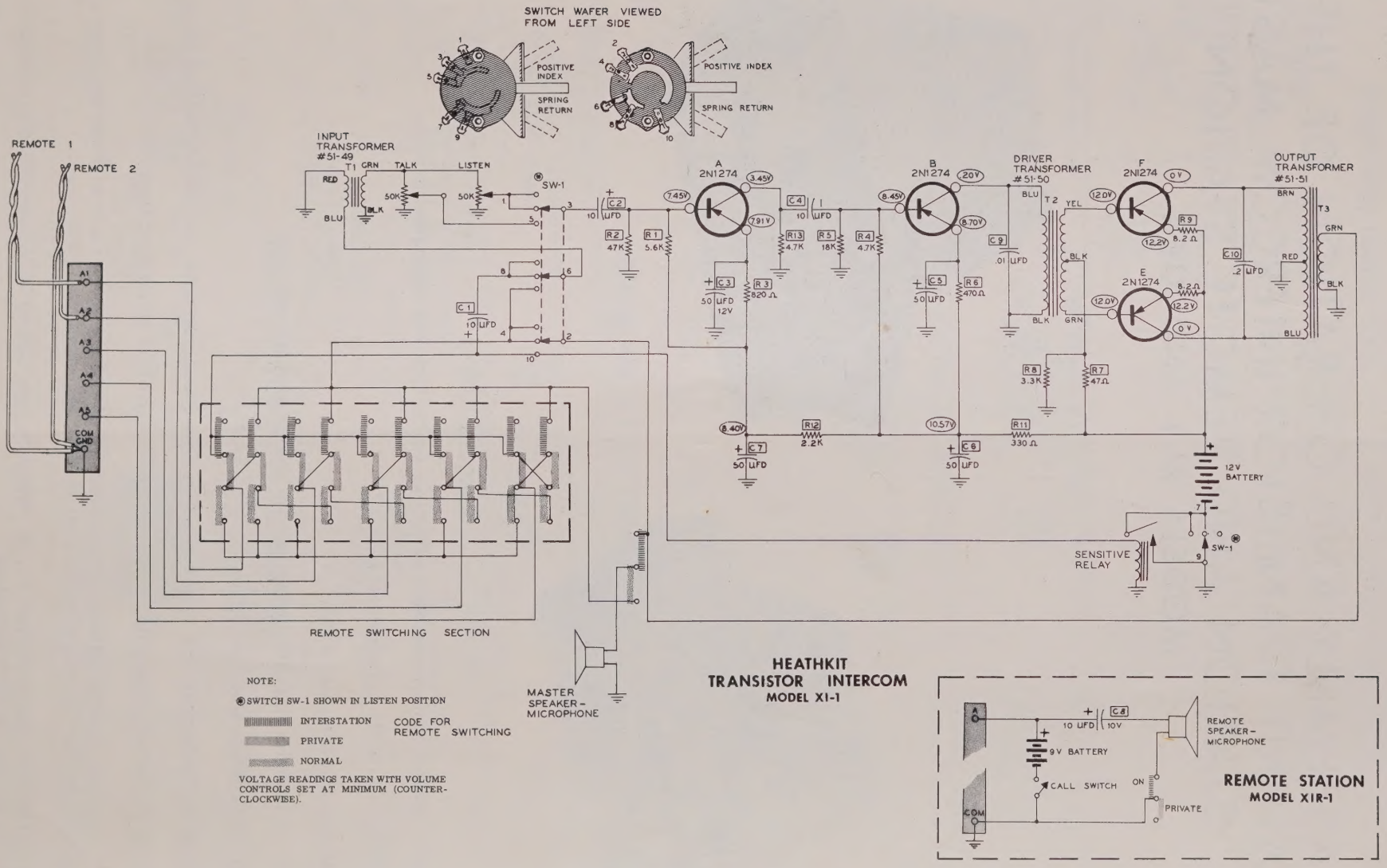
1 watt audio output voice modulated.

Any Remote Station can talk to any other Remote Station through the Master Station Amplifier.

Frequency response specially engineered for crisp clean communication.

Power supplied by eight self-contained size "C" flashlight batteries or will operate from any 12 volt battery or the 110 volt power supply listed on the following page.

One 9 volt battery (Burgess type P6, or Eveready type 226, or RCA type VS300A) in each Remote unit provides call-in control voltage.



NOTE:

◉ SWITCH SW-1 SHOWN IN LISTEN POSITION

CODE FOR REMOTE SWITCHING

- INTERSTATION
- PRIVATE
- NORMAL

VOLTAGE READINGS TAKEN WITH VOLUME CONTROLS SET AT MINIMUM (COUNTER-CLOCKWISE).

HEATHKIT
TRANSISTOR INTERCOM
MODEL X1-1

REMOTE STATION
MODEL X1R-1

Approximate self-contained battery life for different usages.

XI-1 Master Station

Normal home or office use where system is shut off except when conversing: approximately 1 hour total/day for 6 months of service.

Medium usage where unit is on continuously for a time (babysitting, etc.): approximately 3 hours total/day for 3 months of service.

Hard usage where unit is continuously used for music, paging, etc.,: approximately 8 hours total/day for 1 month of service.

The battery in the XIR-1 Remote unit is a 9-volt battery. (This battery is only in use when the Remote CALL switch is pushed, affording nearly shelf life in normal use.)

If your contemplated usage of the Intercom System is in the "hard usage" category, a larger external battery supply using #6 dry cells or the 117 volt Power Supply (Model XP-1) listed below would be recommended.

2-wire cable between Master and each Remote. 50 feet supplied with each Remote station.

Maximum recommended distance between Master and any unit: 1 mile.

Model XP-1 117 volt AC Power Supply: specially designed to operate XI-1 Transistor Intercom amplifier from standard 117 volt 50/60 cycle AC power. Entire Power Supply fits inside the Intercom cabinet, replacing the battery box. (See current Heath Flyer.)

Dimensions (Overall):	XI-1:	6 1/2" high x 7 3/4" deep x 8" wide.
	XIR-1:	5 1/4" high x 5 3/4" deep x 7 3/4" wide.
Net Weight:	XI-1:	3 1/2 lbs.
	XIR-1:	2 lbs.
Shipping Weight:	XI-1:	6 lbs.
	XIR-1:	4 lbs.

INTRODUCTION

The Heathkit Transistor Intercom, Model XI-1, has been designed for use in the home or small business place where an inexpensive, yet flexible intercom system is required. The XI-1 has been engineered to operate with from one to five XIR-1 Remote units and provides instant service without warmup delay. It draws current only when in use and can be turned off between calls; it provides a selective-call or all-call intercom service. Any Remote unit may turn the system on and initiate a call to the Master. Once the Master replies to the call, control of the system is taken over by the Master and the Remote unit need not be touched. The Master can call any combination or all Remote stations at once, if desired. A person being called by the Master need not touch his Remote unit, nor must he necessarily be close to the unit. He can answer from anywhere in the general area. Each Remote station is equipped with a "Private" switch which disconnects it from the system and assures privacy and silence when calls are not desired. Any Remote unit can talk to any one or all other Remote units, as long as there is someone at the Master to set the switches. The XI-1 can be used for baby sitting; the controls can be set so that the baby can be heard at any or all other Remote units in the house. Once set up for this purpose, the Master does not have to be attended. A private call to any Remote unit cannot be interrupted or listened in on by any other Remote unit while a conversation is in progress.

By proper presetting of the Master unit, any prearranged Remote can turn on the system and call the other preset Remotes without the need for an attendant at the Master. By interconnecting the Master with the TCR-1 Transistor Clock Radio or any radio or other program source that is not AC-DC powered, music may be broadcast through any or all remote units.

With the Master station set up in the kitchen of a home, for instance, the housewife can listen in on the children in their room while she continues her household chores. She can even set the switches so that she can hear from any of the other Remotes which may be located in the basement, bedroom, or even the garage. By being able to "look in" on the children or call for somebody in another part of the house without having to leave the kitchen, a good deal of wasted time and energy can be saved. A Remote unit located at the front door can also enable the housewife to determine who is at the door without having to open it or even leave the kitchen. This is only an example of how a system can be set up. Every installation will vary in its requirements and station locations. By careful placement of the Remote units, any section of the house can be within communicating distance of the Master station.

CIRCUIT DESCRIPTION

The XI-1 is basically a three-stage high gain audio amplifier which utilizes transistors instead of vacuum tubes, and includes a special switching section. Those of you who are familiar with the circuitry used in audio amplifiers will recognize the similarities and quickly understand the differences in the circuit required for transistor operation. Those of you who are not familiar with component and circuitry terminology or the nature and function of the components should refer to the Glossary on Page 31. To gain a better understanding of the circuit, refer to the Schematic Diagram as you read.

Sounds picked up by the Remote speaker-mike are converted by the speaker-mike into a varying audio signal which is fed into the switching section of the Master unit. This switching section determines which of the Remotes will be connected to the amplifier. After passing through the switching section, the audio signal is coupled by a 10 μfd electrolytic capacitor, C-1, to the primary of the input transformer, T-1. The input transformer increases the voltage of the audio signal and couples it to the volume controls. The volume controls enable the sensitivity of the intercom to be varied by selecting any portion of the input voltage to be fed to the amplifier. The volume controls are connected to the base of the first transistor amplifier stage A by a 10 μfd electrolytic capacitor, C-2. A 2N1274 transistor is employed in the first amplifier, or predriver stage. A voltage divider consisting of the 5.6 KΩ, R-1, and 47 KΩ, R-2, resistors provide base bias voltage. An 820 Ω emitter bias resistor, R-3, is also used. The 50 μfd electrolytic capacitor, C-3, effectively bypasses the audio signal without shorting out the emitter bias. Amplified output of the predriver stage is coupled to the base of the second stage, or driver transistor B, by another 10 μfd electrolytic capacitor, C-4. Another 2N1274 transistor is employed as the driver with base bias provided by the 4.7 KΩ, R-4, and 18 KΩ, R-5, resistors. A 470 Ω, R-6, resistor supplies emitter bias with a 50 μfd bypass capacitor, C-5. Further amplified output from the driver stage is transformer coupled, T-2, to the output stage consisting of two 2N1274 transistors, E and F, in push-pull. A voltage divider, consisting of the 47 Ω, R-7, and 3.3 KΩ, R-8, resistors, provides base bias through the center tap of the driver transformer secondary. 8.2 Ω resistors, R-9 and R-10, supply emitter bias. The two 2N1274 output transistors are operated "Class B". This means that very little current is taken from the battery except when signal is applied. This results in maximum battery life. The output transformer, T-3, couples and properly matches the two output transistors to the speaker-mike through the switching section.

The combination speaker-microphones in the XI-1 and the XIR-1 are the same and consist of specially designed high efficiency permanent magnet speakers with a 45 Ω coil impedance. This impedance is much higher than that used for ordinary speakers and is so chosen because it offers less line loss when operated over long transmission lines.

The 330 Ω, R-11, and 2.2 KΩ, R-12, resistors and two 50 μfd electrolytic capacitors, C-6 and C-7, provide isolation between circuits and prevent undesirable instability of operation.

The coil of a sensitive relay is connected to the input of the Master station and turns the amplifier on when a DC control voltage is applied by any Remote unit. The control voltage is produced by a 9 volt mercury battery in the Remote unit and switched on momentarily by a spring return switch. The speaker-mike in the Remote unit is coupled to the transmission line by a 10 μfd capacitor, C-8, which allows audio signals to pass through but isolates the speaker from the DC control voltage. The input to the Master amplifier is also isolated with a 10 μfd capacitor, C-1, to keep the DC voltage out of the input transformer. By isolating the line in this way, both the control voltage and the audio signal can be transmitted at the same time over the same two wires without interfering with each other.

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. While the arrangement shown is probably not the only satisfactory arrangement, nevertheless it is the result of extensive experimentation and trial. If followed carefully, it will result in a stable instrument, operating at a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of your manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein, and include all inspection slips in your letter to us. Hardware items are counted by weight and there may be a few more or less than the quantity specified. If a few are missing, please obtain them locally if at all possible.

In order to expedite delivery to you, we are occasionally forced to make minor substitution of parts. Such substitutions are carefully checked before they are approved and parts supplied will work satisfactorily. In checking the Parts List for resistors, for example, you may find that a resistor with a 5% tolerance has been substituted for a resistor with a 10% tolerance, as shown on the Parts List. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -50% are common for electrolytic capacitors.

PROPER SOLDERING TECHNIQUES

Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest proportion of malfunctions are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with the colored insulation (hookup wire); the size of the conductor is the same for all colors of hookup wires furnished with your kit. In the case that bare wire is to be covered with insulating sleeving, the phrase "use sleeving" will be used.

2. Leads on resistors, capacitors and transformers are generally much longer than they need to be to make the indicated connections. In these cases, the excess leads should be cut off before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving.

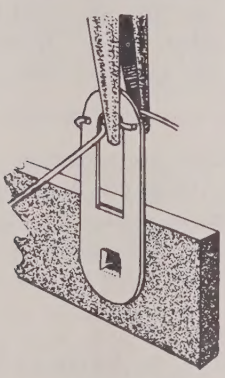
3. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending, position the wire so that a good solder connection can still be made.

4. Position the work, if possible, so that gravity will help to keep the solder where you want it.

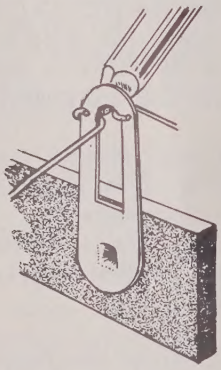
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

6. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.

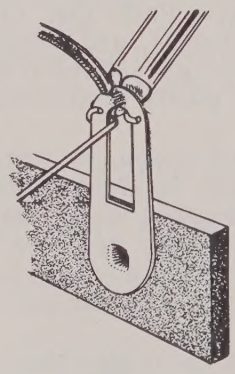
7. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.



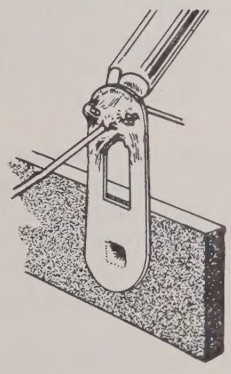
CRIMP WIRES



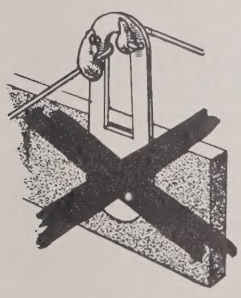
HEAT CONNECTION



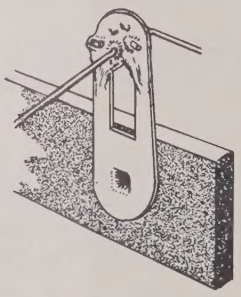
APPLY SOLDER



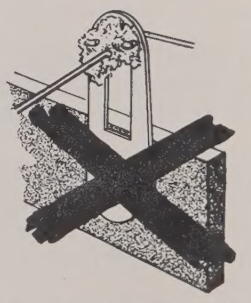
ALLOW SOLDER TO FLOW



COLD SOLDER JOINT
CONNECTION INSUFFICIENTLY HEATED



PROPER SOLDER CONNECTION



COLD SOLDER JOINT
CONNECTION MOVED WHILE COOLING

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

We suggest that you do the following before work is started:

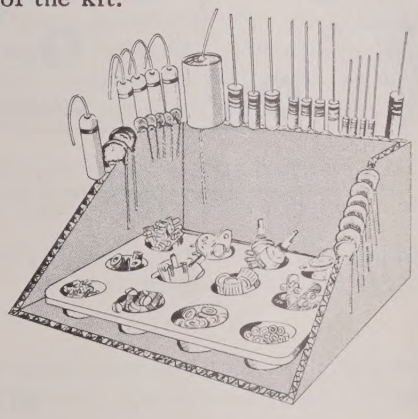
1. Attach the large folded pictorials to the wall above your work bench.

2. Read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations.

3. Lay out all parts so that they are readily available.

4. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

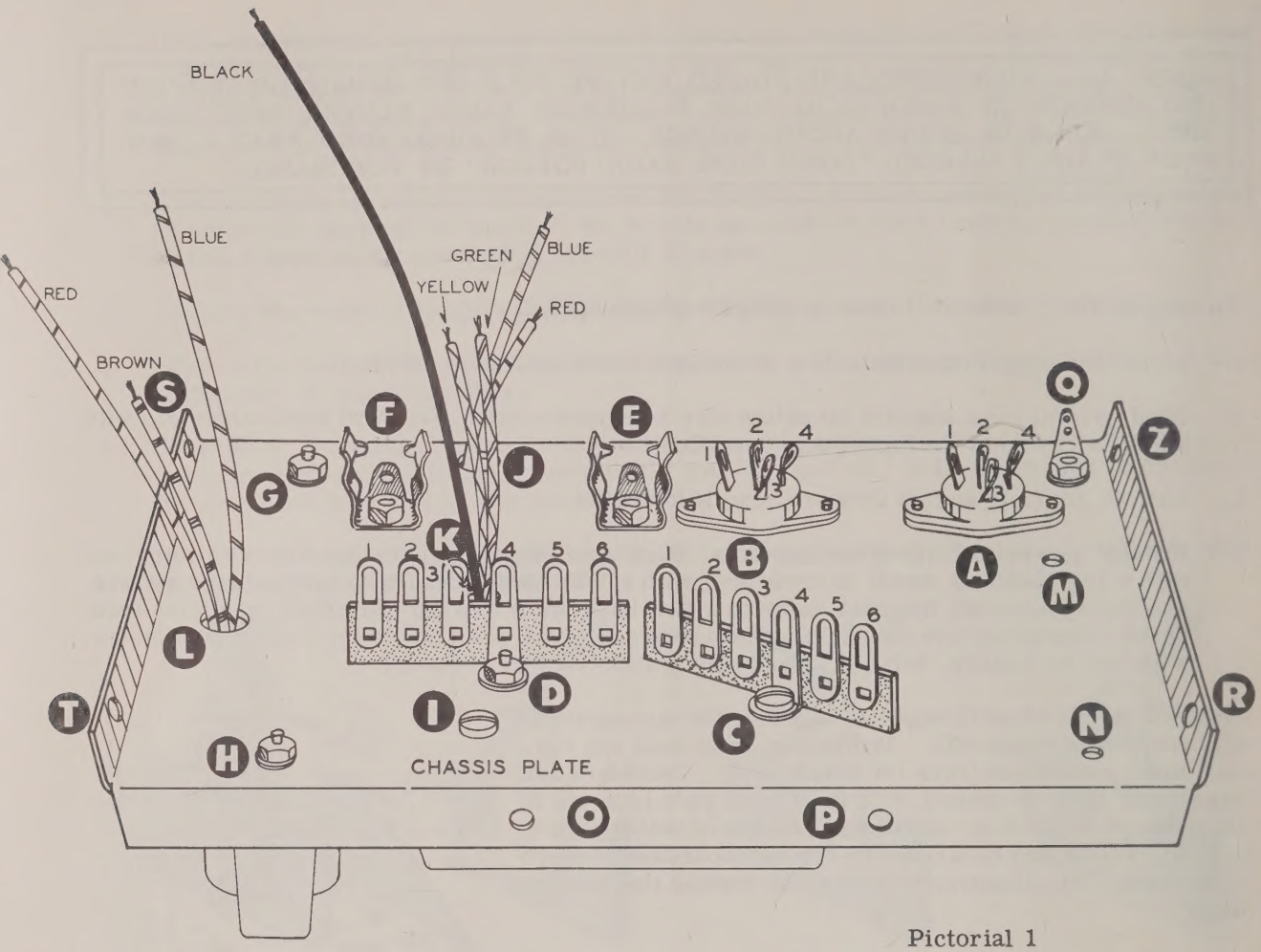
Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the pictorial as it is added.

The abbreviation "NS" indicates that a connection should not be soldered as yet for other wires may need to be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in question before it is soldered. For example, if the instruction reads, "Connect one lead of a 47 KΩ resistor to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered. This additional check will help avoid errors.



Pictorial 1

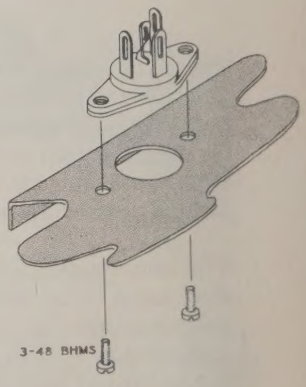
STEP-BY-STEP CONSTRUCTION

Refer to Pictorial 1 for the following steps.

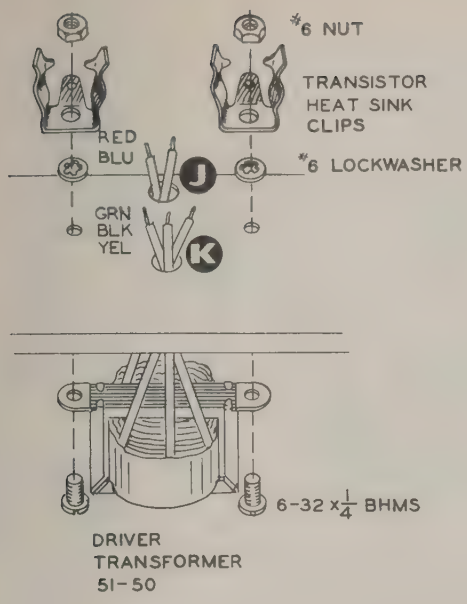
( ) Position the chassis plate as shown in Pictorial 1. Mount one of the transistor sockets at hole A on the chassis plate, with the lugs positioned as shown in Detail 1. Use the small 3-48 BHMS. These screws will thread into the plastic so no nuts will be required. Be careful not to overtighten or the plastic socket may crack.

( ) Mount the other transistor socket at hole B, positioning as in the previous step. Again be careful not to overtighten mounting screws.

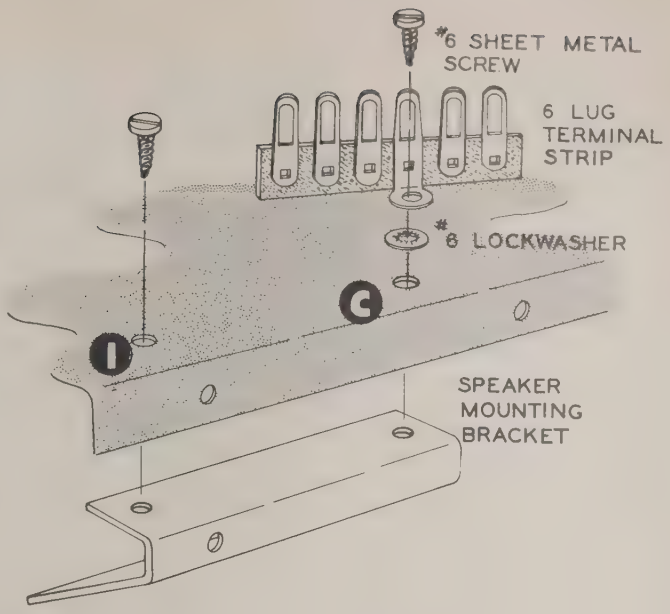
( ) Mount the driver transformer (#51-50). The red and blue leads protrude through hole J and the green, yellow and black leads through hole K. The two transistor heat sink clips will mount at E and F with the same hardware used for the transformer, as shown in Detail 2 on Page 9. Fasten with 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts. Slide the nuts into the heat sink clips before placing clips over end of screws. NOTE: The lockwasher is inserted between the chassis and the heat sink clip. Position the clips as shown in Pictorial 1.



Detail 1



Detail 2



Detail 3

( ) Mount the output transformer (#51-51). If the transformer ears interfere with the chassis flanges, file or clip a small amount of metal from the end of the ears. The red, brown and blue leads should protrude through hole L. Leave the green and black leads free on top of the chassis. Fasten with 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts at H and G.

( ) Mount one of the 6-lug terminal strips at D, as shown. The terminal strip should be parallel to the sides of the chassis. Use 6-32 x 1/4" BHMS, #6 lockwasher and 6-32 nut.

( ) Mount the speaker mounting bracket at I as shown in Detail 3, with #6 x 3/8" sheet metal screws. Before tightening, make sure that the chassis hole at C lines up with the other bracket mounting hole.

( ) Mount the other 6-lug terminal strip at C with a #6 x 3/8" sheet metal screw. Place a #6 lockwasher between the chassis and the terminal strip as shown. Refer to Detail 3. This terminal strip should be placed on an angle with lug 1 near lug 6 of terminal strip D.

( ) Mount a #6 solder lug at Q with 6-32 x 1/4" hardware. No lockwasher is necessary.

CHASSIS WIRING

Refer to Pictorial 2 on Page 10 for the following steps.

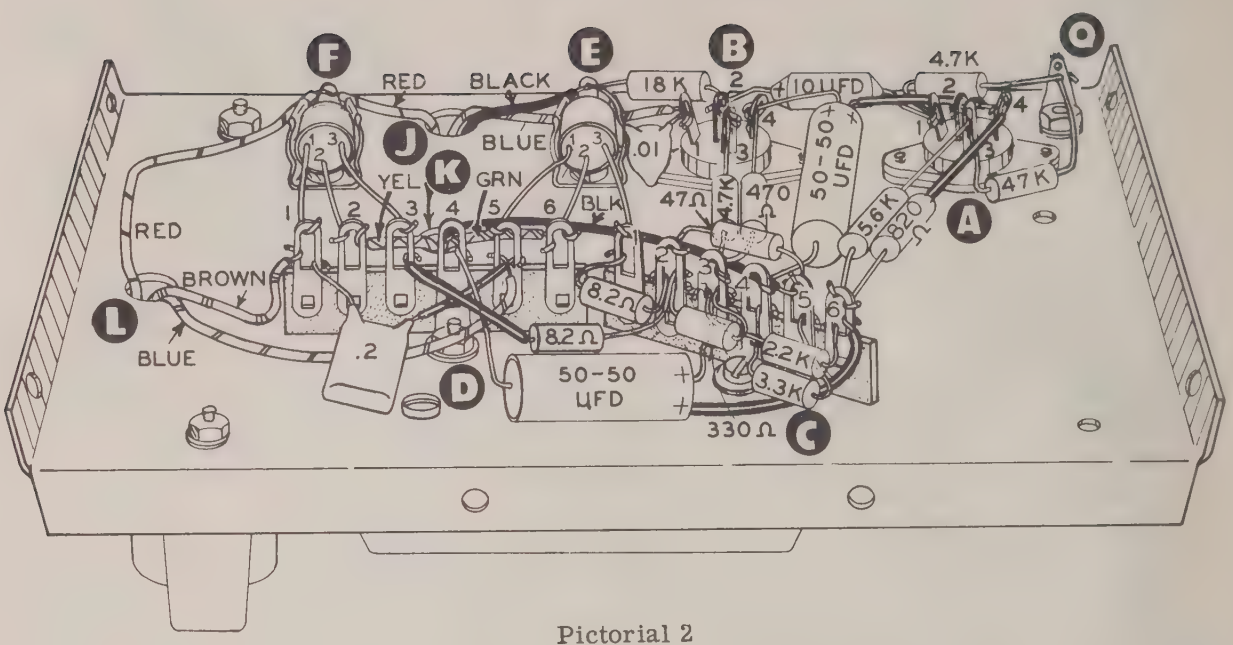
( ) Connect the red transformer lead from hole L to the ground lug on the heat sink clip at F (NS).

( ) Connect the red transformer lead from hole J to the ground lug at F (S-2).

( ) Connect the red transformer lead from hole J to the ground lug at F (S-2).

( ) Connect the blue lead from hole J to lug 1 of transistor socket B (NS).

NOTE: Disregard pin numbers moulded in the transistor socket. Always refer to numbering on pictorial diagram.



Pictorial 2

( ) Take the black lead from the output transformer (#51-51) (above the chassis) and pass it between the output transformer and the driver transformer (#51-50), then down through hole J with the driver transformer leads. Connect the lead to the ground lug at heat sink clip E (NS).

( ) Install the .01 µfd disc capacitor as shown between the socket lug B1 (S-2) and ground lug E (NS).

( ) Install an 18 KΩ (brown-gray-orange) resistor between ground lug E (S-3) through socket B2 (NS) and B3 (NS).

( ) Connect the yellow wire from hole K to terminal strip D2 (NS).
( ) Connect the green wire from hole K to terminal strip D6 (NS).

( ) Connect the black wire from hole K to terminal strip C5 (NS).

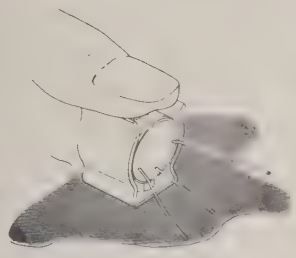
( ) Connect the blue wire from hole L to terminal strip D5 (NS).
( ) Connect the brown wire from hole L to terminal strip D1 (NS).

( ) Install a .2 µfd Mylar capacitor between D1 (NS) and D5 (NS). Use sleeving on the lead to D5.

( ) Locate the small bag containing the set of four transistors. NOTE: The letter printed on the outside of the bag will be either A, B, C or D. The transistors are color coded with a small color dot on the case of each one. According to the letter stamped on the bag, select two transistors of the colors as follows: Bag A, two violet; Bag B, two blue, Bag C, two green; Bag D, two yellow. Replace the remaining two transistors in the bag for use later.

CAUTION: The transistors can be damaged by excessive heat while soldering. To avoid damage, grasp the lead with pliers between the body of the transistor and the point of soldering. The pliers will absorb the heat. Do not release the pliers until the connection has cooled. Someone else may be of assistance at this point or a "third hand" may be improvised by wrapping the handles of your long-nosed pliers with a rubber band. This will enable you to clamp the pliers on the lead.

( ) Insert the two transistors into the heat sink clips at E and F. Note that the leads of the transistor form a triangle where they leave the case; the transistors should be installed in the clips with this triangle exactly as shown in Detail 4.



Detail 4

( ) Connect transistor lead F1 to terminal strip D1 (S-3).
( ) Connect lead F2 to terminal strip D2 (S-2).

( ) Connect lead F3 to terminal strip D3 (NS).
( ) Connect lead E1 to terminal strip D5 (S-3).

( ) Connect lead E2 to terminal strip D6 (S-2).
( ) Connect lead E3 to terminal strip C1 (NS).

( ) Install an 8.2 Ω (gray-red-gold-gold) resistor between terminal D3 (S-2) and C2 (NS). Use sleeving as shown. (Remember to connect heat barrier on transistor lead to prevent overheating.)

( ) Install another 8.2 Ω (gray-red-gold-gold) resistor between C1 (S-2) and C2 (NS).

( ) Install one of the 50-50 μfd electrolytic capacitors as shown with the single lead connected to lug D4 (S-1) and the other leads to C3 (NS) and C6 (NS). Use sleeving on lead to C6.

( ) Install a 4.7 KΩ (yellow-violet-red) resistor between transistor socket B3 (NS) and lug C3 (NS).

( ) Connect the positive (+) lead of one of the 10 μfd electrolytic capacitors to transistor socket B2 (S-2). At this time also solder B3 (S-2). Connect the other lead of the capacitor to socket A1 (NS).

( ) Install a 4.7 KΩ (yellow-violet-red) resistor as shown at socket A between A1 (S-2) and the bottom hole in the solder lug at Q (NS).
( ) Install a 470 Ω (yellow-violet-brown) resistor between socket B4 (NS) and C3 (NS).
( ) Position a 47 KΩ (yellow-violet-orange) resistor as shown at socket A between A3 (NS) and the bottom hole in solder lug Q (NS).

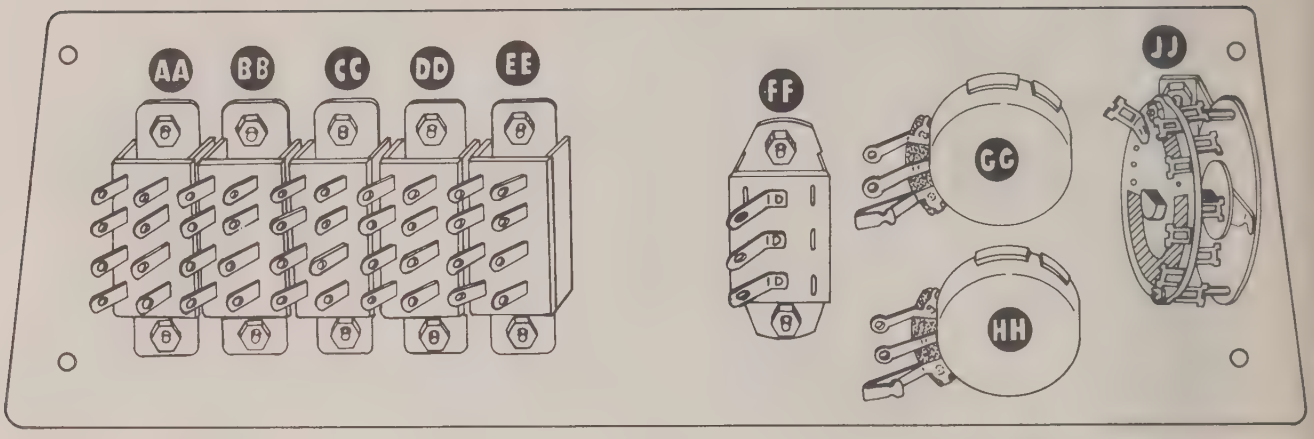
( ) Install a 5.6 KΩ (green-blue-red) resistor between lug C6 (NS), through A3 (S-2) and A2 (NS). Leave the leads long enough to pass around the input transformer which will mount between holes M and N.

( ) Install an 820 Ω (gray-red-brown) resistor between socket A4 (NS) and lug C6 (NS). Use sleeving on end connected to A4. Again leave the leads long enough to miss the input transformer.

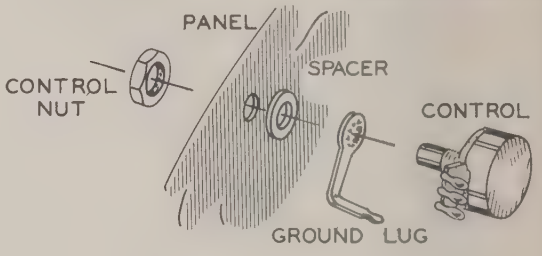
( ) Install the remaining 50-50 μfd electrolytic capacitor. The single lead connects to lug C4 (NS). One of the positive (+) leads connects to socket B4 (S-2), the other to socket A4 (S-2). Use sleeving on the lead to A4.

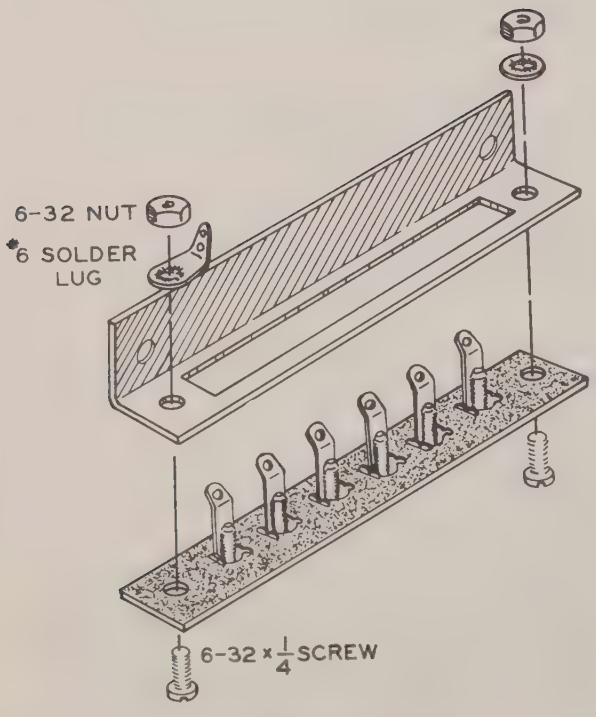
( ) Connect a 3.3 KΩ (orange-orange-red) resistor between lug C4 (S-2) and lug C5 (NS).
( ) Connect a 47 Ω (yellow-violet-black) resistor between lug C5 (S-3), and lug C2 (NS).
( ) Install a 2.2 KΩ (red-red-red) resistor between lug C6 (S-4) and lug C3 (NS).
( ) Install a 330 Ω (orange-orange-brown) resistor between lug C3 (S-5) and lug C2 (NS).

This completes the wiring of the chassis for the time being. It might be a good idea at this time to recheck all solder connections. There should be only three unsoldered connections: Terminal strip C2, transistor socket A2, and solder lug Q. If you find any other points that have not been soldered, check against Pictorial 2 to see that a part has not been omitted. If all parts are in place, solder the connection. Temporarily set the chassis aside.

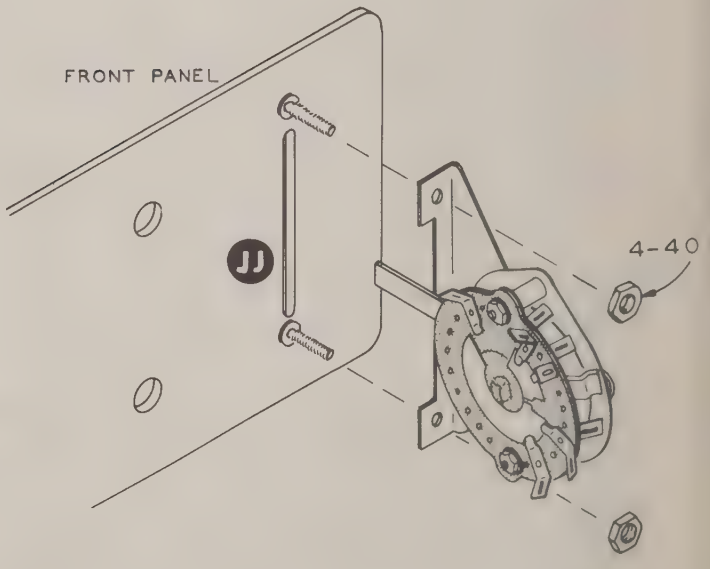


Pictorial 3





Detail 5



Detail 6

FRONT PANEL ASSEMBLY AND WIRING

( ) Locate the terminal strip mounting bracket (the right angle bracket with the long slot) and the 6-lug screw type terminal strip.

( ) Mount the terminal strip to the bracket as shown in Detail 5. Use 6-32 x 1/4" hardware. A #6 solder lug should be installed at one end, as shown.

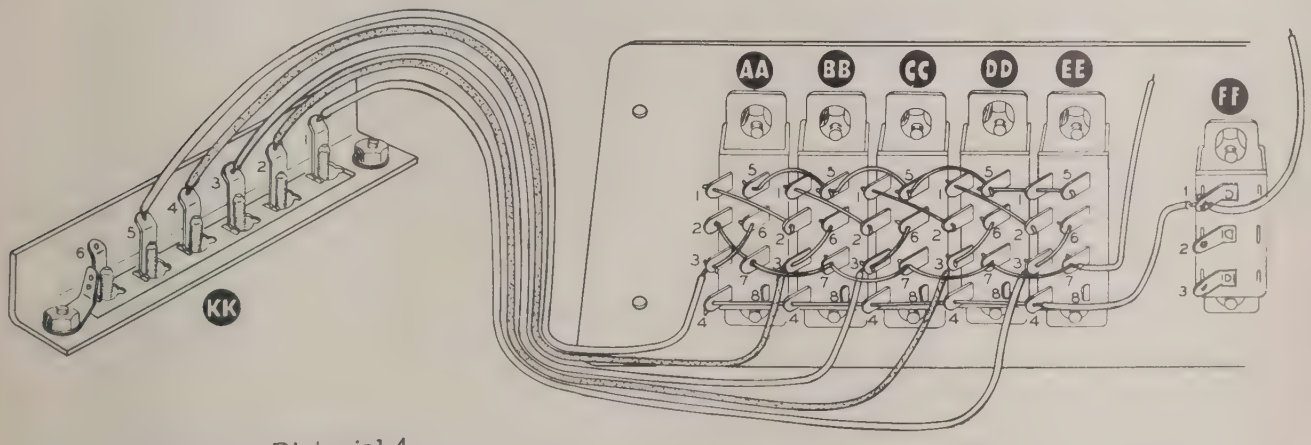
( ) Referring to Pictorial 3, locate the front panel and the five 3-position slide switches. Install the five switches on the panel at AA, BB, CC, DD and EE. Use 4-40 nuts only; lockwashers interfere with the operation of the switches. Position the switches in the center of the cut-out holes and tighten the nuts with long-nose pliers. The 4-40 nuts are packaged in a separate envelope.

( ) Install the 2-position slide switch at FF as above.

( ) In a similar fashion install the lever switch at JJ, as shown in Detail 6. Before tightening the nuts position the switch so that the lever does not hit the sides of the slot.

( ) Mount the two controls at GG and HH. Use a control ground lug and spacer washer between the panel and the control bushing inset at left, with the ear positioned as shown. The two black control nuts should be used.

NOTE: The 3-position slide switches will now be wired. Note the numbering sequence, which is the same for each switch. Care must be exercised in working with the switches so that short circuits will not result from wires accidentally touching each other, or from excess solder which has run between the switch lugs. Be sure the panel is positioned as shown in Pictorial 4.



Pictorial 4

( ) With a side cutting pliers clip off lug 8 from each of the five switches. Cut the lugs about halfway down their length.

( ) Cut a piece of bare wire 3 3/4" long and slide through lugs EE4, DD4, CC4, BB4, and AA4. Slip a 1" piece of sleeving over the end protruding from EE4 and connect to FF1 (NS). Now solder EE4 (S-1), DD4 (S-1), CC4 (S-1), BB4 (S-1), and AA4 (S-1).

( ) Cut a piece of hookup wire 3" long and strip 1/4" insulation from each end. Connect one end to FF1 (S-2) and leave the other end free.

( ) Cut five pieces of hookup wire 7" long for use in the following steps. Strip 1/2" of insulation from one end of each piece, and 1/4" from the other end of each piece.

( ) Take one of the prepared wires and slip the end with the 1/2" insulation removed, through EE3 from the left to EE6. Solder both joints.

( ) Locate the preassembled terminal bracket and position as shown, next to the front panel.

( ) Bend the ground lug near terminal KK6 over until it touches KK6 and solder the two together.

( ) Connect the free end of the wire leading from the front panel switch EE to terminal lug KK1 (S-1).

( ) Take another of the prepared wires and slip the end with the 1/2" insulation removed through switch lug DD3 (S-1) to lug DD6 (S-1). Connect the other end to KK2 (S-1).

( ) In like manner, connect a wire through CC3 (S-1) to CC6 (S-1). Connect the other end to KK3 (S-1).

( ) Connect a wire through BB3 (S-1) to BB6 (S-1). Connect the other end to KK4 (S-1).

( ) Connect a wire through AA3 (S-1) to AA6 (S-1). Connect the other end to KK5 (S-1).

( ) Dress the five leads along the bare wire running through the #4 lugs on the five switches.

( ) Cut five pieces of bare wire 7/8" long. Bend them in the shape of a U and insert one between switch lugs AA2 (S-1) and AA7 (NS).

( ) Insert another wire between AA7 (S-2) and BB7 (NS).
( ) Insert another between BB7 (S-2) and CC7 (NS).

( ) Insert another between CC7 (S-2) and DD7 (NS).
( ) Insert the last between DD7 (S-2) and EE7 (NS).

( ) Cut a piece of hookup wire 5" long and strip both ends. Connect one end to EE7 (S-2). Leave the other end free.

( ) Cut four pieces of bare wire 3/4" long. Slip one through lug AA1 (S-1) and run to BB2 (S-1).

( ) Connect another of the prepared wires between BB1 (S-1) and CC2 (S-1).

( ) Likewise, connect another wire between CC1 (S-1) and DD2 (S-1).
( ) Connect the last wire between DD1 (S-1) and EE2 (S-1).

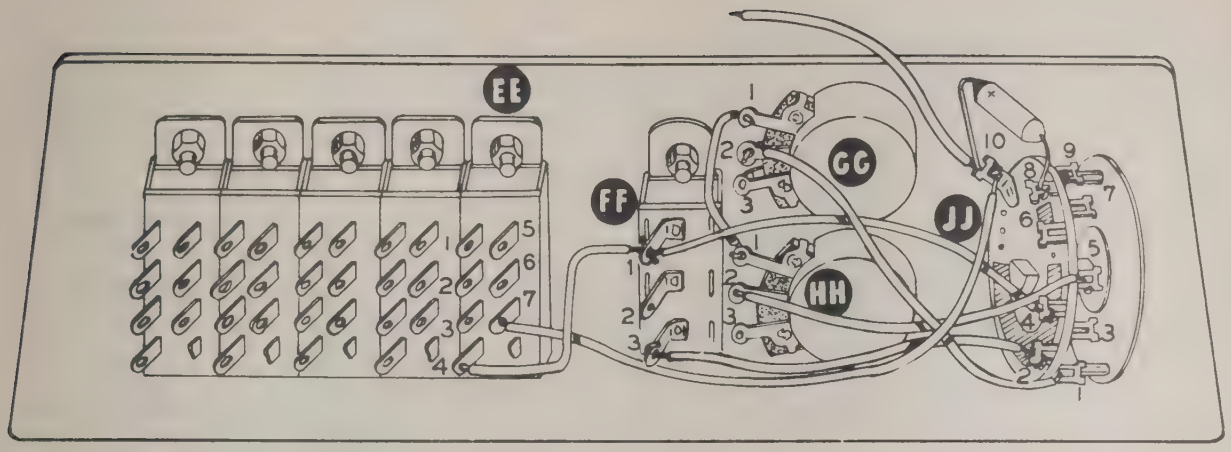
( ) Check and make sure that the four wires just installed do not touch any of the other switch lugs. Bend the wires if necessary to provide clearance.

( ) Cut four pieces of bare wire 7/8" long. Bend three of them in the shape of a U and insert one between switch lugs AA5 (S-1) and BB5 (NS).

( ) Connect another between BB5 (S-2) and CC5 (NS).

( ) Connect the last U shaped wire between CC5 (S-2) and DD5 (NS).

( ) Insert the last straight piece through EE5 (S-1) to EE1 (S-1) and on to DD5 (S-2). Clip off excess wire at EE5.
( ) Check over all the switches and make sure that no shorts exist between switch lugs and wiring and that all connections are soldered. If any are found that are not soldered, check the wiring against the Pictorial to make sure that no wires have been left out and solder the connection.



Pictorial 5

Refer to Pictorial 5 for the following steps.

( ) Bend the ground lugs mounted under the two controls so that they touch GG3 (S-1) and HH3 (S-1).

( ) Connect the loose end of the lead soldered to FF1 to lever switch lug JJ4 (S-1).

( ) Connect the loose end of the lead soldered to EE7 to lever switch lug JJ10 (NS).

( ) Connect the positive (red) lead of one of the 10 μfd electrolytic capacitors to JJ10 (NS). Connect the other lead to JJ8 (S-1).

( ) Strip both ends of a 6" length of hookup wire and connect the one end to lug JJ10 (S-3). Leave the other end free.

( ) Connect a 3" length of hookup wire between FF3 (S-1) and JJ2 (NS).

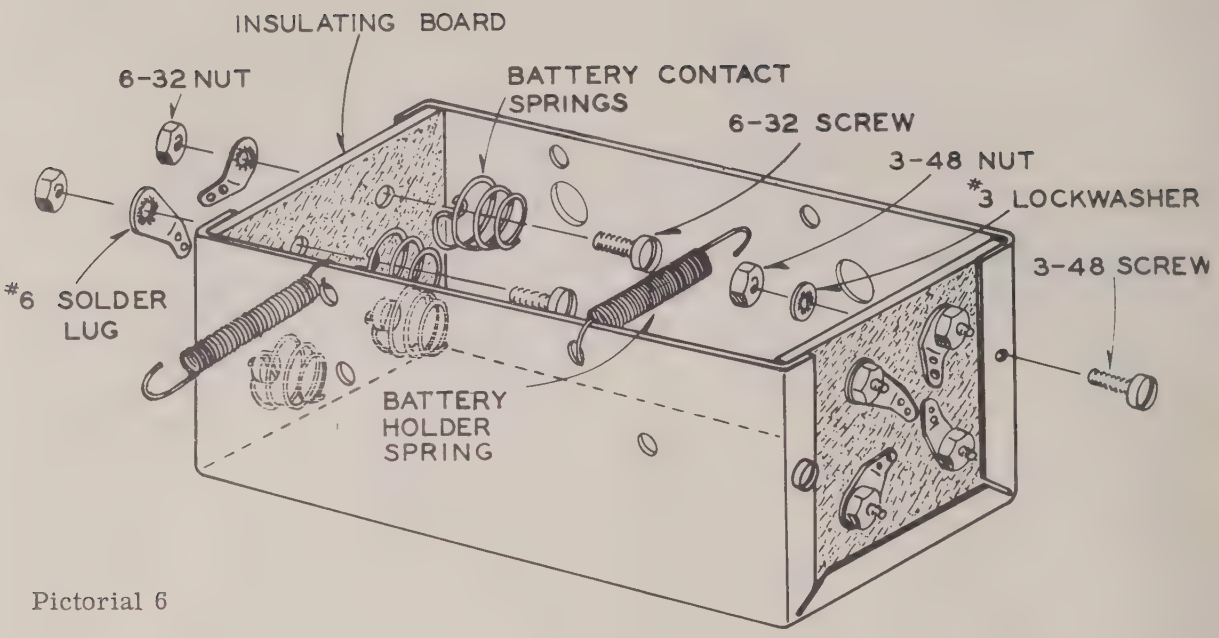
( ) Connect a 1 3/4" length of hookup wire between HH1 (S-1) and GG1 (NS).

( ) Connect a 3" length of hookup wire between GG2 (S-1) and JJ1 (S-1).

( ) Connect a 3" length of hookup wire between HH2 (S-1) and JJ5 (S-1).

This completes the front panel wiring. Set this part aside for the time being.

IF AN AC POWER PACK, Model XP-1, has been purchased for use with the XI-1, disregard the steps on BATTERY BOX ASSEMBLY (Pages 16, 17 and 18 marked with an asterisk*). Construct the XI-1 Power Pack before continuing assembly on the XI-1 Intercom.



Pictorial 6

BATTERY BOX ASSEMBLY

*( ) Locate one of the insulating boards and mount the four battery contact springs as shown in Pictorial 6. Use 6-32 x 3/8" hardware with a #6 solder lug under the nuts, as shown. Position the four solder lugs so that the terminal ends point toward the center of the board.

*( ) Locate the battery box housing and position as shown in Pictorial 6, with the two mounting holes toward you.

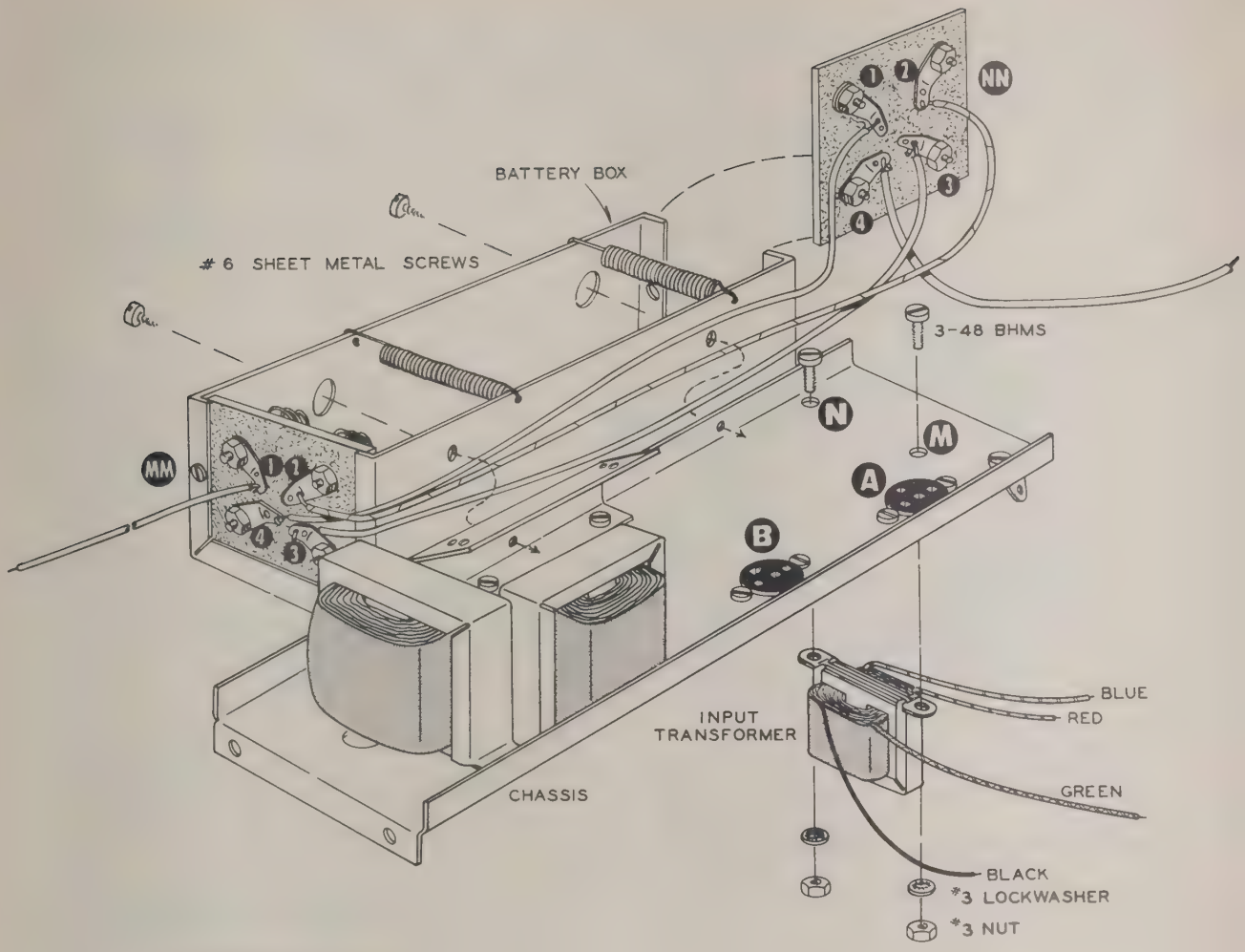
*( ) Using 3-48 hardware, bolt the insulating board into the battery box housing. The board goes on the inside of the mounting flanges as shown. The top edge of the board should be flush with the top of the metal box edge.

*( ) Locate the other insulating board and install 6-32 x 3/8" bolts through the four holes, with #6 solder lugs under the nuts as on the other insulating board. Again face the terminal ends of the lugs toward the center of the board.

*( ) Install the insulating board in the battery box with 3-48 hardware. Again mount the board on the inside of the flanges.

*( ) Hook the closed loop of the battery holder springs into the two small holes on the front edge of the battery box. The other end of the springs should then hook into the holes across the box.

In the following steps refer to Pictorial 7. Note that the right hand end of the battery box is purposely distorted so that the wiring of the end board can be seen.



Pictorial 7

*( ) Fasten the battery box to the chassis with #6 x 3/8" sheet metal screws, with the heads on the inside of the battery box as shown.

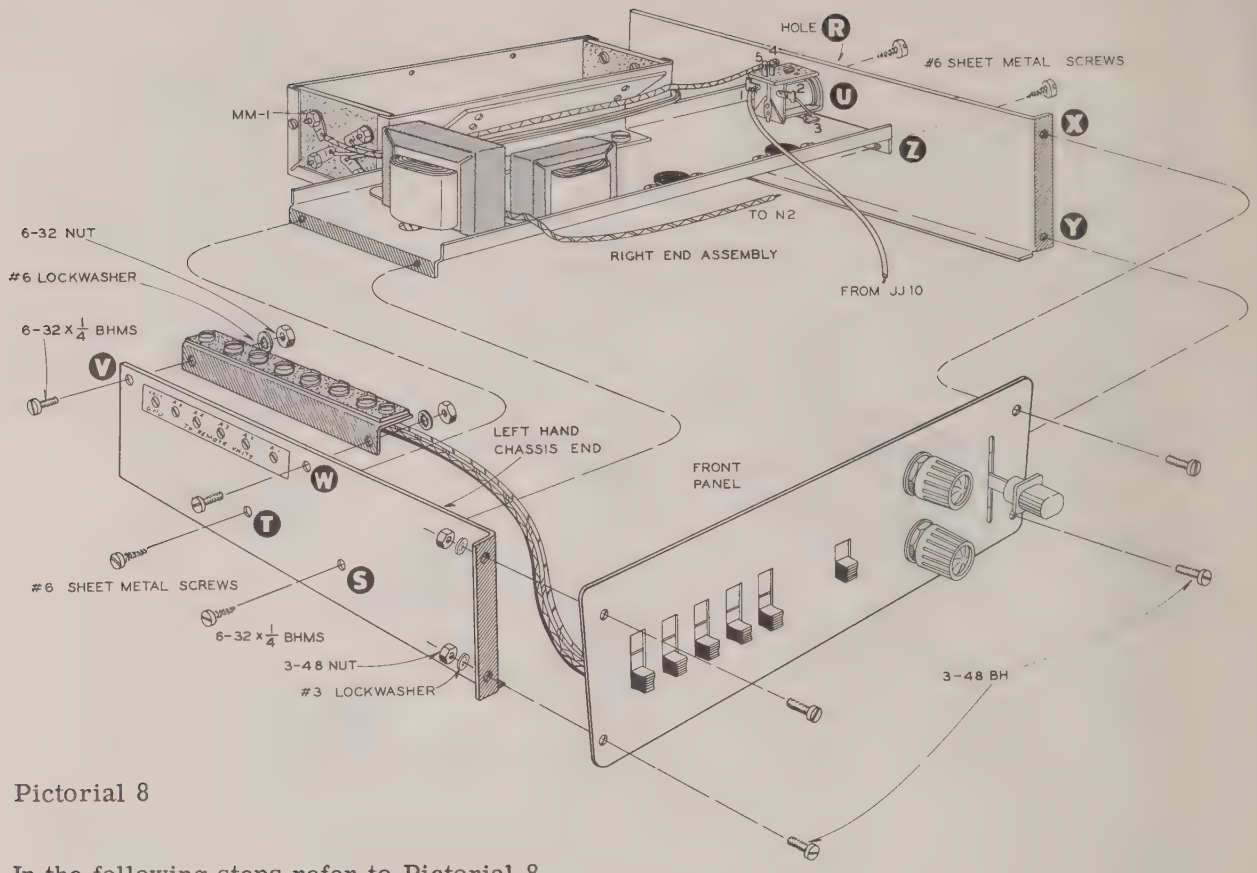
*( ) Cut three pieces of hookup wire 7 3/4" long and strip both ends. Connect one between terminal board MM3 (S-1) and terminal board NN3 (S-1).

*( ) Connect another wire from MM4 (S-1) to NN1 (S-1).

*( ) Connect the third wire from MM2 (S-1) to NN2 (S-1).

*( ) Cut and strip both ends of a 5" piece of hookup wire and connect between terminal NN4 (S-1) and terminal strip C2 (S-5) on the bottom of the chassis.

( ) Mount the input transformer at M and N on the chassis with the transformer oriented so that the red and green leads exit at the end toward mounting hole M. Use 3-48 hardware. Dress all the leads in the same direction as the red and green leads.



Pictorial 8

In the following steps refer to Pictorial 8.

( ) Mount the right hand chassis end to the chassis at R and Z with #6 x 3/8" sheet metal screws.

( ) Mount the sensitive relay at U with a 6-32 nut and lockwasher. A #6 spacer washer should be placed between the relay and the chassis end.

*( ) Prepare an 8" length of hookup wire and connect between battery box terminal MM1 (S-1) and relay lug U4 (NS).

THE FOLLOWING 3 STEPS ARE USED FOR EXTERNAL BATTERY CONNECTION ONLY.

( ) Cut two pieces of wire long enough to reach from the XI-1 to the external battery supply and strip both ends of the wires.

( ) Connect one end of one wire to NN4 on the battery box (S-2). Mark the end of this wire with a piece of masking or freezer tape (+). This is the POSITIVE battery lead.

( ) Connect one end of the other prepared wire to battery box terminal MM1 (S-2). Mark the end of this wire (-). This is the NEGATIVE battery lead.

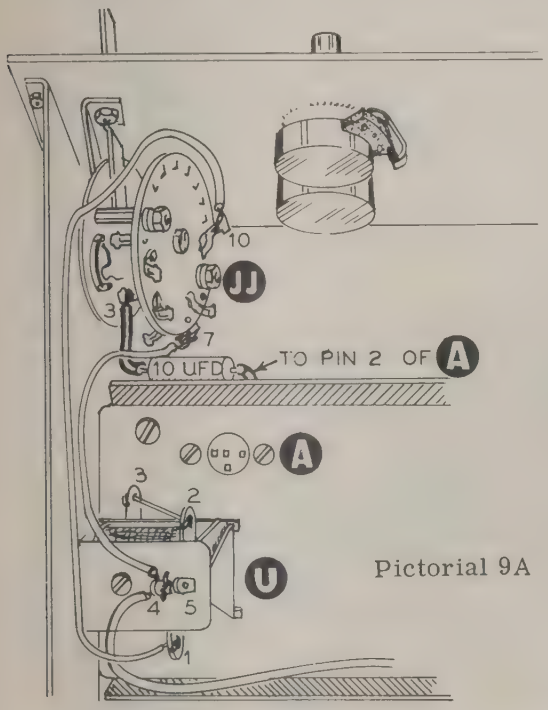
It is very important that external battery polarity match the marking on the two battery wires or the Intercom will be inoperative and the transistors and other components might be damaged. DO NOT connect the external battery until told to install batteries in the TEST PROCEDURE section of this manual.

This completes the special wiring required to operate the Intercom from an external battery supply.

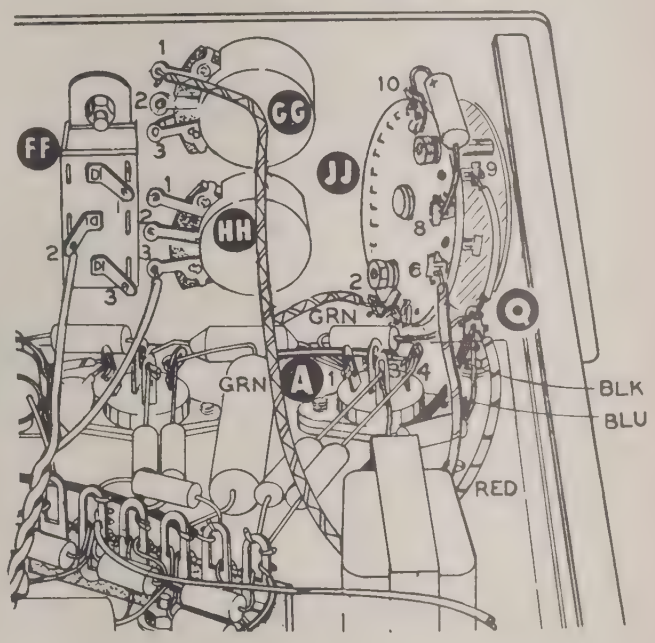
( ) Locate the left hand chassis end and mount it to the front panel, as shown, with 3-48 hardware.

( ) Mount the terminal strip already wired to the front panel, to the chassis end at V and W, using 6-32 x 1/4" hardware.

( ) Now join the chassis right end assembly to the front panel left end assembly. Use #6 x 3/8" sheet metal screws at S and T, and 3-48 hardware at X and Y.



Pictorial 9A



Pictorial 9B

Refer to Pictorial 9A for the following steps.

( ) Cut the negative lead of the remaining 10 μfd electrolytic capacitor to 1 1/4" long. Slip a 1" piece of insulating sleeving over the lead and connect it to lever switch lug JJ3 (S-1).
( ) Slip a 1/2" length of sleeving over the positive (+) lead of the 10 μfd electrolytic capacitor just installed. Connect this lead to transistor socket A2 (S-2).

( ) Connect the wire leading from lever switch lug JJ10 to relay lug U1 (S-1).
( ) Prepare a 3 3/4" length of hookup wire and connect it between lever switch lug JJ7 (S-1) and relay lug U4 (S-2). Relay lug U5 must be left entirely free. No connection should be made to this lug.

( ) Using bare wire, connect relay lugs U2 (S-1) and U3 (S-1).

Refer to Pictorial 9B for the following steps.

( ) Connect the green output transformer (#51-51) lead to lever switch lug JJ2 (S-2). Do not confuse this transformer with the smaller input transformer.

( ) Connect the loose end of the 47 KΩ resistor at A3 to the ground lug at Q (NS).
( ) Connect the loose end of the 4.7 KΩ resistor at A1 to the same point (NS).
( ) Connect the red and black leads from the input transformer to the same ground lug (NS).
( ) Connect a hookup wire from lever switch lug JJ9 (S-1) to the ground lug at Q (S-5).
( ) Connect the blue lead from the input transformer to switch lug JJ6 (S-1).

( ) Connect the green lead from the input transformer to control GG1 (S-2).
( ) Prepare two 15" lengths of hookup wire. Connect one to slide switch FF2 (S-1). Leave the other end free.

( ) Connect one end of the other 15" piece to the control ground lug at HH3 (S-1).
( ) Twist the two wires together and bend aside for connection later.

( ) Locate the bag containing the remaining two transistors. Note the letter printed on the outside of the bag and pick the following transistor: if Bag A, one brown transistor; Bag B, one red transistor; Bag C, one red transistor; Bag D, one orange transistor.

( ) Clip the three leads on this transistor to 1/4" long and insert the transistor carefully into socket A on the chassis. This is the socket closest to the right hand chassis end plate. Disregard the contact in the center of the transistor socket; only the three outside contacts should be used with this transistor. Be careful when inserting the transistor into the socket so that the leads are not bent or strained.

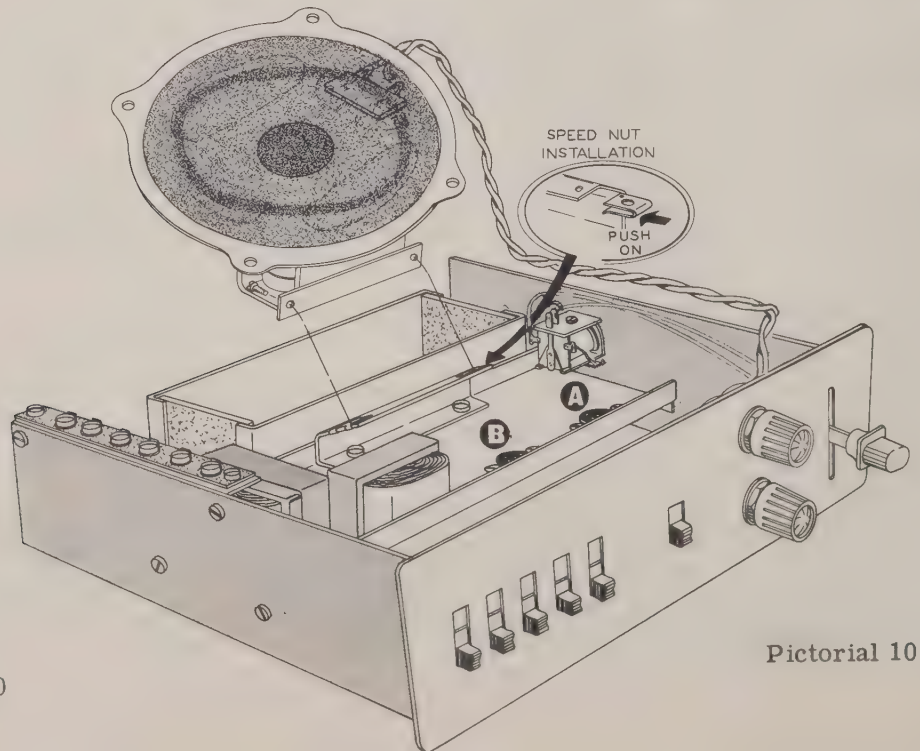
( ) Clip the leads of the remaining transistor to 1/4" long and plug it in transistor socket B. Again disregard the center contact in the socket.

( ) With the chassis setting right side up, slip two speednuts over the speaker mounting bracket as shown in Pictorial 10. Use the pair of holes closest to the edge of the bracket. The speednuts should be installed with the flat side up and the formed side down.

( ) Temporarily mount the speaker to the mounting bracket with two 6-32 x 3/8" screws. The speednuts act as the threaded nut.

( ) Connect the two twisted wires to the two speaker terminals and solder both connections.
( ) Install the two knobs on the two control shafts and tighten with a screwdriver.

( ) Slip the lever switch knob (top hat) on the lever switch shaft with the flat sides toward the top and bottom of the panel.
( ) Install the two knobs on the control shafts.



Pictorial 10

( ) With a pair of scissors, separate the sections of the printed label. One part is the terminal indicator for the Remote Stations and the main portion of the label indicates proper battery installation.

( ) Remove the paper backing from the BATTERY INSTALLATION label and stick the label down in the bottom of the battery box. The label should be oriented so that the lettering can be read from the front of the Master unit.

( ) Remove the backing from the TERMINAL INDICATION label and place it on the left chassis end plate at the screw type terminal strip. The label should be on the same centers as the terminal strip mounting screws with the terminal marked A1 toward the front of the unit.

This completes the wiring of the Intercom Master. It is suggested that a Remote unit be constructed and the two tested together before installing them in their cabinets.

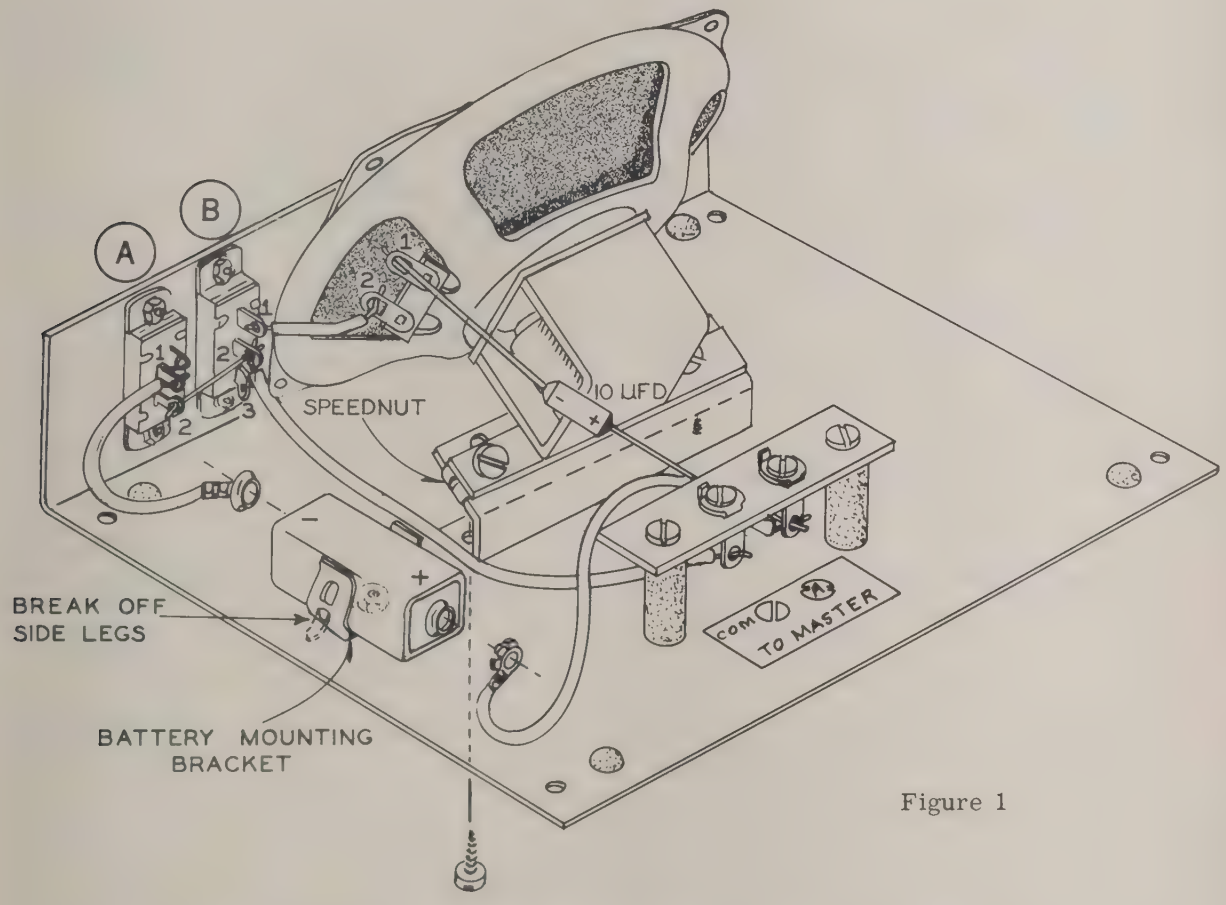


Figure 1

CONSTRUCTION OF THE XIR-1 INTERCOM REMOTE STATION

Refer to Figure 1

( ) Install the single-pole double-throw slide switch at B on the chassis front. Use two 4-40 nuts without lockwashers for mounting.

( ) Install the spring return slide switch at A in a similar manner. The switch should be installed so that the switch button is normally in the "up" position.

( ) Insert the four rubber feet into the four large holes near the corners. The feet should be installed from the bottom with the smaller end forced through the hole.

( ) Install the speaker mounting bracket as shown in Figure 1, using #6 BH sheet metal screws.

( ) Slip two speednuts (with the smooth side up) onto the flange of the bracket at the lower pair of holes (closest to the bend).

( ) Install the battery mounting bracket as shown with 6-32 x 1/4" hardware. Break off the two side legs of the battery mounting bracket with long-nose pliers. Refer to Figure 1.

( ) Screw the two threaded spacers to the 2-lug screw type terminal strip with 6-32 x 1/4" machine screws.

( ) Mount the terminal strip spacer assembly to the bottom plate, as shown, with two more 6-32 x 1/4" machine screws.

( ) Strip the backing off the TERMINAL INDICATION label and stick it to the bottom plate just in the back of the terminal strip. Orient the label so that it can be read from the back.

( ) Install the speaker on the mounting bracket with two 6-32 x 3/8" machine screws threaded into the speednuts.

( ) Cut a length of hookup wire 7" long and strip 1 1/4" of insulation from one end. Strip 1/4" of insulation from the other end. Pass the longer bare end through the switch terminal B2 (S-1) to switch terminal A2 (S-1).

( ) Connect the other end to the common lug of the screw type terminal strip (S-1).

( ) Prepare a 2" length of wire and connect it between switch terminal B1 (S-1) and speaker lug 2 (S-1).

( ) Prepare a 2 1/2" length of wire and solder one end to the negative (-) battery connector. This is the solder lug that looks like a small button.

( ) Connect the other end of the wire to switch lug A1 (S-1).

( ) Prepare a 5" length of wire and solder one end to the positive (+) battery connector. This is the solder lug with a series of curved springs around the outside.

( ) Connect the other end to the terminal strip lug marked A (NS).

( ) Connect the negative lead of the 10 μfd electrolytic capacitor to speaker terminal 1 (S-1). Connect the positive lead to terminal strip lug A (S-2).

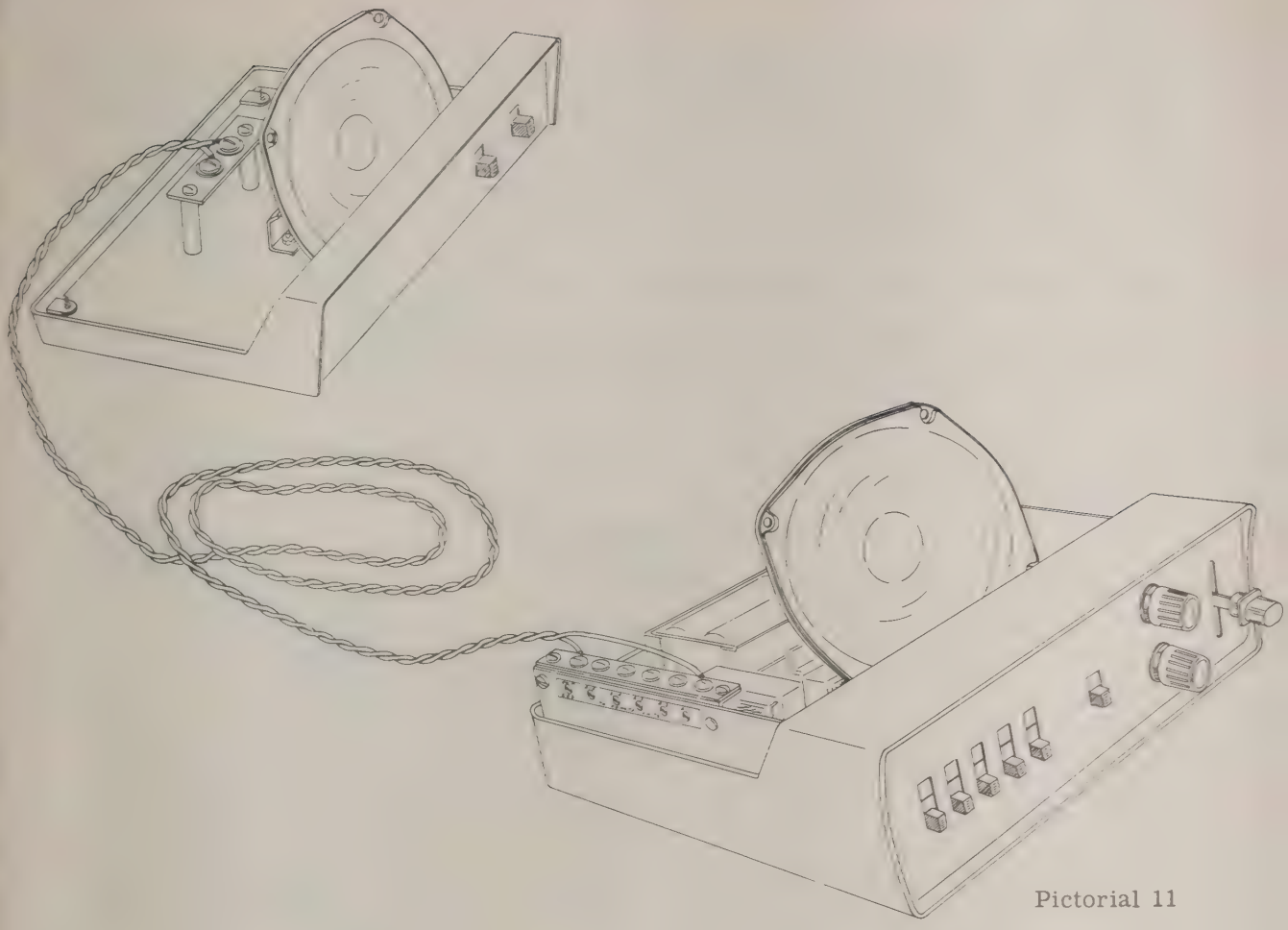
This completes the wiring of the Remote station.

TEST PROCEDURE

In case some difficulty turns up during the test procedure, refer to the IN CASE OF DIFFICULTY section on Page 32.

Refer to Pictorial 11 for the following steps.

( ) Connect one end of the length of twisted wire supplied with the Remote unit to the screw type terminal strip on the Remote. Note which color wire you connect to the terminal marked COM. Connect the other end of the wire to the Common and A1 terminals of the Master station. The wire connected to the Common on the Remote should be connected to the Common terminal on the Master.



Pictorial 11

( ) Put the PRIVATE switch on the Remote in the ON or up position.
( ) Put the TALK-LISTEN lever switch on the Master in the OFF or up position.

( ) Switch all the slide switches on the Master to NORMAL or down.
( ) Turn both VOLUME controls full counterclockwise.

( ) Place eight new size "C" flashlight batteries in the battery box of the Master unit. Be careful to insert the batteries exactly as shown on the BATTERY BOX label.

NOTE: If an XP-1 Power Pack Kit has been installed instead of the battery box, plug the power cord into a convenient 110 V 50/60 cycle AC power socket and continue the test procedure.

( ) Turn the TALK-LISTEN lever switch to LISTEN. A very slight noise or hiss should be heard from the Master station.

( ) Now turn the LISTEN VOLUME control clockwise. A sound originating at the Remote should now be heard at the Master. The volume of this sound is controlled by the LISTEN VOLUME control. If a continuous howl or singing noise is produced when the control is turned up, this is caused by having the Remote station too close to the Master. This is known as feedback and is common with any amplifying system. If a Remote unit is to be placed nearby to the Master, the VOLUME control will have to be left at a lower level to prevent feedback. In general, all stations should be separated in some way from each other, preferably by a wall or partition.

( ) Next turn the TALK VOLUME control clockwise to about the halfway point. Push the TALK-LISTEN switch to TALK. Any sound at the Master should now be heard at the Remote. The TALK VOLUME control determines the volume of the sound at the Remote stations and only comes into use when the LEVER switch is pushed to TALK.

( ) Insert a 9 volt battery in the Remote battery holder and clip the two battery contacts to their respective terminals.

( ) Switch the Master station TALK-LISTEN switch to OFF.

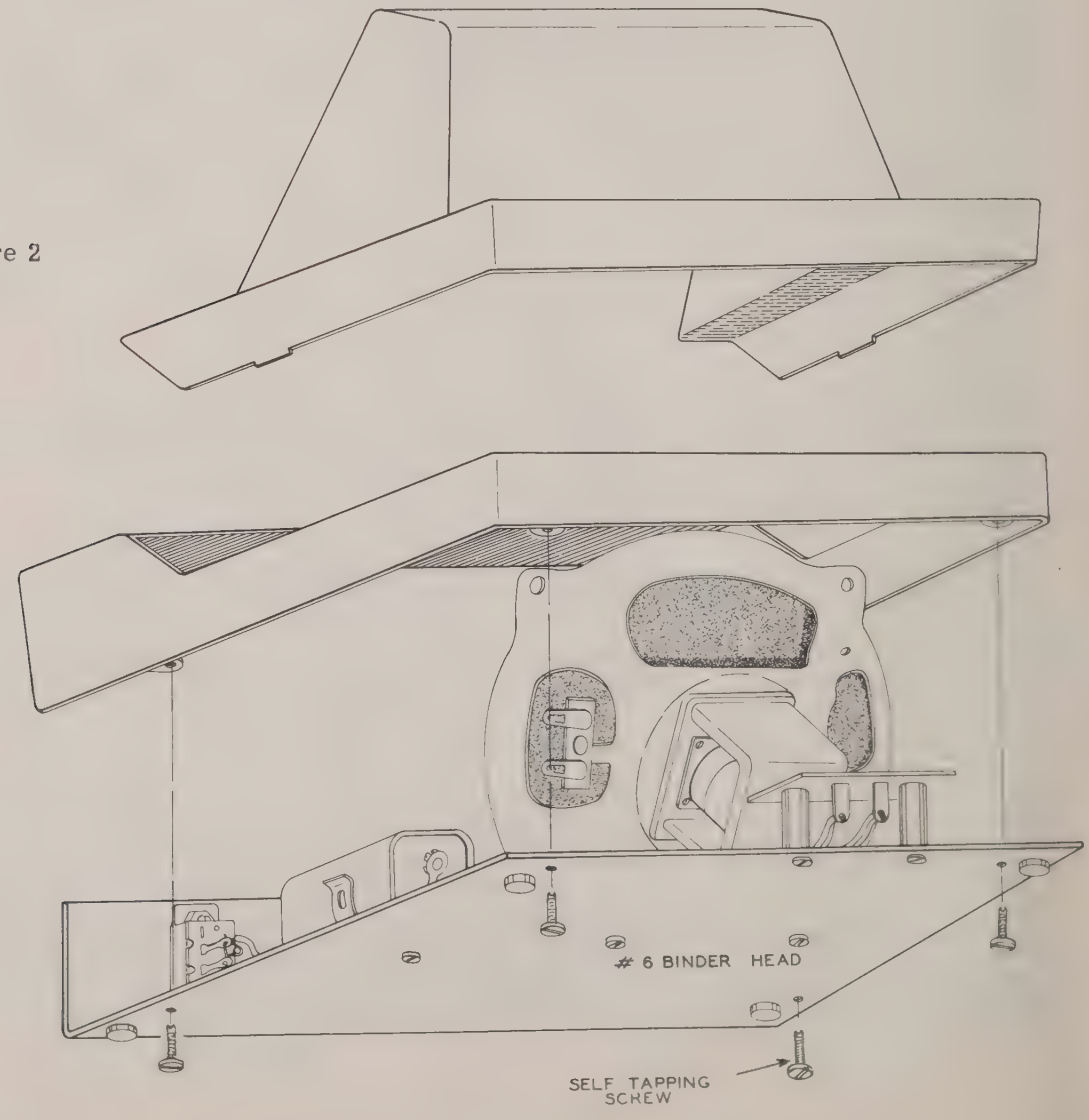
( ) Pushing the CALL switch on the Remote should turn on the Master so that any sound made at the Remote can be heard at the Master. The Master will only remain on as long as the CALL switch is held down.

( ) If the units have passed these tests, they are operating properly and can be installed in their respective cabinets.

CABINET INSTALLATION

Refer to Figures 2 and 3 for the following steps.

Figure 2



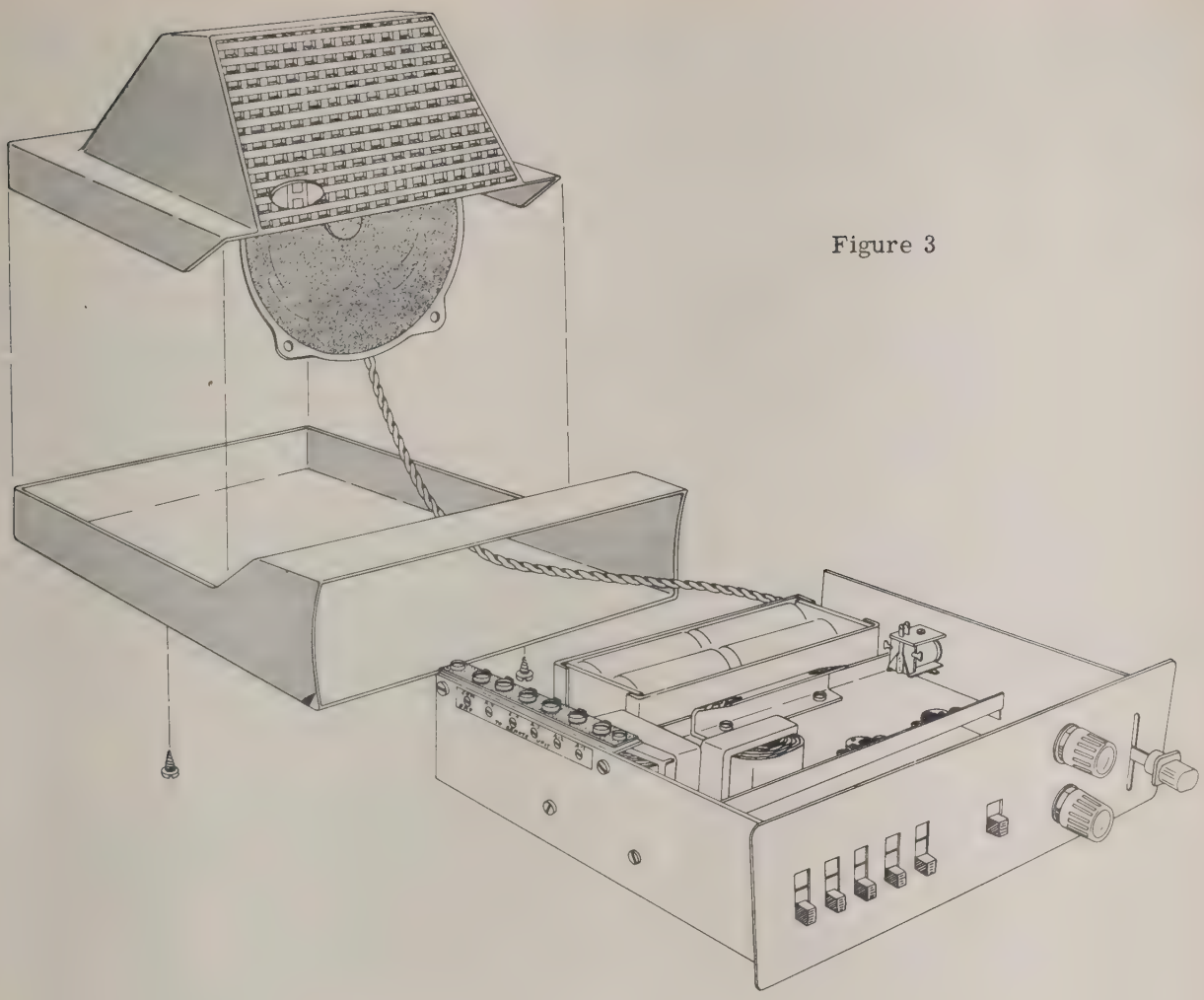


Figure 3

( ) Remove the speaker from the Master station. It will only be necessary to remove the two screws holding the speaker to the mounting bracket. Do not unsolder the wires to the speaker.

( ) Slip the speaker into the cabinet shell from the front. Slide the chassis into the shell after the speaker. Secure the chassis to the cabinet shell with two #6 x 5/8" sheet metal screws inserted as shown. The screws pass through the two holes in the bottom of the cabinet shell and into holes in the chassis. Do not overtighten these mounting screws as this might overstress and cause the plastic cabinet to crack.

( ) Replace the speaker on the mounting bracket and bolt it back down as before.

( ) Remove the paper backing from the "H" nameplate and stick it to the raised portion of the moulded speaker grille on the cabinet top.

( ) Place the cabinet top onto the cabinet shell so that it snaps in place. To change batteries, remove the top only. Holes have been provided in the back of the cabinet shell for entrance of the Remote wires.

( ) This completes the Master station.

( ) Slide the remote bottom plate and panel into place on the moulded cabinet base and secure there with the four self-tapping screws supplied. The screws will form their own threads in the plastic mounting holes. Do not overtighten the mounting screws.

( ) Remove the paper backing from the "H" nameplate and stick it to the speaker grille on the cabinet top and snap the top in place on the cabinet base.

This completes the Remote station.

INSTALLATION AND OPERATION

The Master station should be installed in a handy location where it can be easily reached to operate the controls. The cabinet should be placed so that the person operating the unit is in front of and a little above it. The reason for this is that the sound quality both on talking or listening will be the best with the person situated in front of the speaker-mike. The person does not necessarily have to be close to the speaker-mike to talk but he should speak towards the unit rather than at an angle across it.

The Remote units should be placed so that sounds originating in the area to be covered by the unit are in front of the speaker-mike. Sounds originating behind or far to the side of the unit will lack clarity and distinctness. If a large area is to be covered and one Remote unit cannot adequately handle the area, two Remote units can be hooked in parallel on the same circuit. In This way one pair of wires will suffice for both units. With any combination of Remotes, the maximum number of Remotes must not exceed five.

INTERCONNECTING WIRING

The XI-1 and XIR-1 have been designed to operate with a 2-wire transmission line. This means that only two wires are required between the Master and each Remote. Fifty feet of twisted 2-conductor wire is supplied with each Remote station. If a longer distance is to be covered, any 2-conductor twisted wire of 22 gauge or larger can be used. Transmission line lengths of up to a mile between Master and Remote stations can be tolerated by the XI-1 and XIR-1 without excessive line loss or loss of frequency response. Most electronic supply and repair shops carry a line of intercom or other comparable wire.

In general, keep intercom wiring as far away from 60 cycle power wiring circuits as possible to keep hum from being induced into the intercom circuit. This is especially important over very long wire runs. The common wires from all Remote stations connect to the common terminal on the Master. It may be difficult to hold all wires under the one screw terminal, so it is suggested that all common wires be twisted together and then the one bundle tightened under the screw terminal.

It is recommended that the Master be connected to an external water pipe or other suitable ground. This ground wire should be connected to the terminal marked COM GND on the Master. The Remote units should not be grounded as they are connected to ground through their Master. An external ground is recommended because it reduces the susceptibility of the system to hum and noise pickup. Occasionally, however, conditions do occur where an external ground may raise the noise level; if this happens, just leave off the external ground. The system will operate satisfactorily without it.

OPERATION

The operation of the XI-1 and XIR-1 is simple, once the functions of the front panel controls on the Master are understood. The lever switch turns the system on and controls the TALK-LISTEN functions of the amplifier. In the LISTEN position, the amplifier is turned on and the Master is "listening" to the Remote. In the TALK position, the Master is "talking" to the Remote. The switch automatically returns to the LISTEN position when released from the TALK position. When the switch is in the OFF position, the wiring remains connected as it was in the LISTEN position, except that the power to the amplifier is shut off. Thus when a Remote station pushes his call button, turning on the amplifier power, the Master is still on LISTEN and the call is heard on its speaker the same as if the Master switch were on LISTEN.

There are two volume controls on the panel of the Master. One controls the TALK volume; that is the volume of the sound being sent to the Remote stations. The other controls the LISTEN volume; that is the volume of the sound coming from the Remote stations. Two controls are used because it allows a person close to the Master to talk with someone at some distance from the Remote without having to continually change the volume setting.

The input slide switches on the Master control the selective-call and other functions.

NORMAL: In the NORMAL position or down, all Remotes are connected to the input of the amplifier. That is, if the lever switch were turned to LISTEN, all Remotes would be heard at the same time. If the lever switch were turned to TALK, the Master would be talking to all Remotes at the same time. Whenever the Master is turned to OFF, ALL the slide switches should be returned to the NORMAL position. This allows any of the Remote stations to turn the system on and call in.

PRIVATE: By moving any switch to the PRIVATE position, all switches in the NORMAL position are disconnected. This means that if switch #1 were turned to PRIVATE and the others left in NORMAL, the Master would be listening and talking to only Remote #1. All other Remotes would be disconnected completely and could neither hear, talk or call in. This is the reason for returning all switches to NORMAL after a conversation. If it is desired to talk to more than one Remote but not all five at the same time, all that is necessary is to switch those Remotes to PRIVATE. EXAMPLE: The Master wishes to make an announcement to Remotes #1, #2 and #3, but not to #4 and #5. Slide switches #1, #2 and #3 are turned to PRIVATE, with #4 and #5 left in NORMAL. This connects #1, #2 and #3 to the Master and leaves #4 and #5 out. When the TALK-LISTEN lever switch is turned to TALK, the Master TALKS to #1, #2 and #3.

When any one or more switches are turned to PRIVATE, all switches in NORMAL are disconnected. When unit is turned off all switches must be left in NORMAL to make it possible for any Remote to call in.

INTERSTATION: The INTERSTATION position is used only when one Remote wishes to talk to another Remote. The procedure to make an interstation call is described in the following example: Remote #1 wishes to talk to Remote #2. Remote #1 calls in to the Master and identifies himself. The Master then switches switch #1 to PRIVATE, which allows him to talk to Remote #1 privately. Remote #1 explains that he wishes to talk to Remote #2. The Master then throws switch #2 to the INTERSTATION position, leaving switch #1 in the PRIVATE position. Now Remote #2 is hearing Remote #1 just as the Master is. The Master should now switch the 2-position slide switch to INTERSTATION. This is the switch to the right of the five station switches. This switch disconnects the talk function of the Master station and allows the Master to listen to both sides of the conversation. With the TALK-LISTEN lever switch in the LISTEN position, Remote #1 is talking to Remote #2. With the TALK-LISTEN lever switch in the TALK position, Remote #2 talks to Remote #1. The Master will have to monitor the conversation and do the switching for the Remotes. On any interstation call, the station switched to PRIVATE will be talking when the lever switch is in LISTEN. The station switched to INTERSTATION will talk when the lever switch is switched to TALK. Remember after any call to switch all switches back to NORMAL or the system will not be open for any Remote to call in.

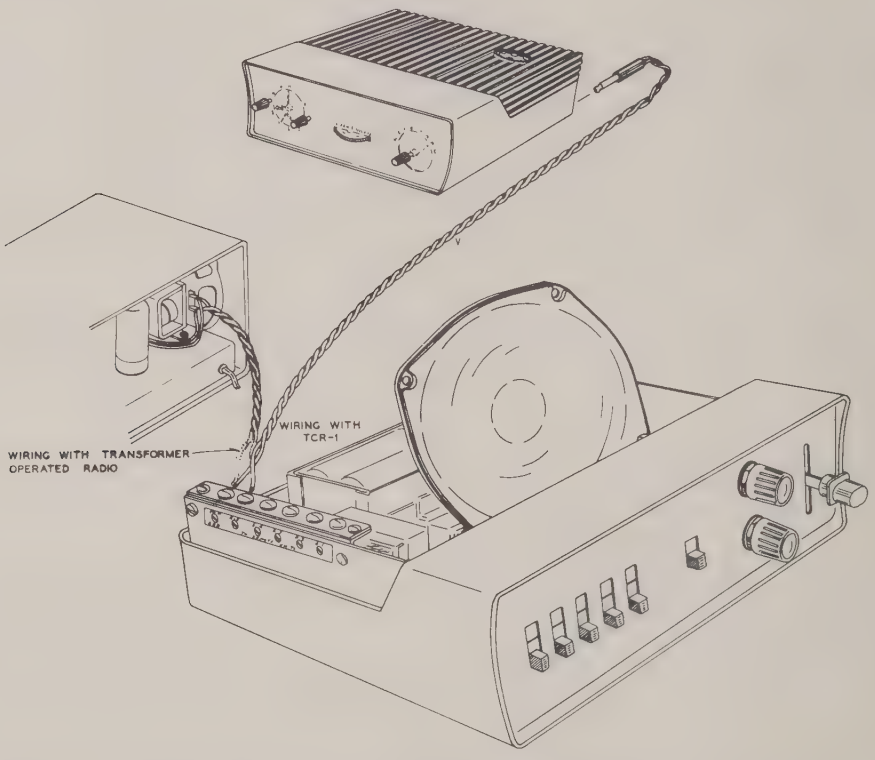
PRESETTING THE MASTER

It is possible to set the Master so that a one-way call can be made between Remotes without attending the Master. Example: Station #1 wishes to make announcements to stations #2 and #3, but does not require an answer. Switch #1 to PRIVATE because he will be doing the talking and switches #2 and #3 to INTERSTATION as they will be listening. Leave the lever switch on OFF. The system will be turned on when the call switch at station #1 is pushed to CALL and the announcement made. The system will be turned off when the call button is released. Only station #1 will be able to control the system and only on a talk basis.

Another preset arrangement may be used for monitoring a station from any or all other stations on a continuous basis, as might be used for babysitting. Example: The baby's room is station #1. It is desired to be able to listen in on the baby from any of the other stations. The baby, or station #1, is switched to PRIVATE as this is the sound source. Any of the other stations wishing to monitor are switched to INTERSTATION. With the TALK-LISTEN lever switch in LISTEN, all stations switched to INTERSTATION will be monitoring the station switched to PRIVATE. If used for babysitting, this would allow the babysitter to move near any Remote to listen in to the baby. Since the system is running on a continuous basis, the Master need not be attended. Again remember to switch all switches to NORMAL when the system is turned off.

MUSIC DISTRIBUTION WITH THE XI-1

By connecting the XI-1 to a radio or tuner (NOT AN AC-DC TYPE), it is possible to provide music at all stations. The following is an example of an XI-1 connected with a Heathkit TCR-1 Transistor Clock Radio.



Pictorial 12

A jumper cable is prepared to run from terminals A5 and COM on the intercom and the miniature headphone jack on the clock radio. By connecting a radio to the intercom, the maximum number of Remotes is reduced to four because the radio utilizes the switching normally used by the fifth Remote.

The connection to a Heathkit TCR-1 is shown, however, the connection to any radio would be similar. On a radio that does not have a headphone jack, the jumper cable should be connected to the two speaker wires on the radio speaker.

> CAUTION: The XI-1 should never be connected to an AC-DC type of radio as a dangerous shock hazard might result.

The switching for music distribution is similar to that for babysitting. Throw the station #5 (radio) switch to PRIVATE as this is the sound source. Switch the stations where music is desired to INTERSTATION and turn the lever switch to LISTEN. The radio jumper wire will have to be removed or provided with a disconnect switch to operate the intercom in the normal fashion or else the radio speaker will overload the intercom, causing distortion and very low output.

If it is desired to always use the XI-1 with a radio for music distribution, the slide switch for Remote station #5 can be rewired so that it will be unnecessary to disconnect the radio externally when the system is used as in intercom. This change will, however, limit the intercom to a maximum of four Remote stations, with the fifth only usable with a radio connection. To make the change, use the following Step-By-Step procedure:

( ) Remove the bare wire jumper between slide switch lugs AA4 and BB4.
( ) Remove the jumper between lugs AA3 and AA6.

The radio wires should always be connected to the COM. and A5 terminals.

The radio connection is now controlled bystation switch #5. The PRIVATE position connects the radio, the NORMAL position disconnects the radio. The INTERSTATION position is no longer used on switch #5. All other slide switches operate exactly as before.

POWER SUPPLY

The XI-1 has been designed to operate from standard size "C" flashlight batteries. These batteries were chosen because they are inexpensive and readily available from most hardware and drugstores. Battery life will vary with the type of use the intercom receives and can be expressed only in general terms. Refer to the SPECIFICATIONS for battery life expectancy.

The battery in the XIR-1 Remote unit is a 9-volt battery. This battery is only in use when the Remote CALL switch is pushed, affording nearly shelf life in normal use.

If the XI-1 is to be used on a continuous basis for background music, paging, or any hard usage where batteries might near the minimum life expectancy, it is suggested that the unit be connected to a larger external battery supply. Any battery or group of batteries supplying 12 volts DC can be used to power the XI-1. It would only be necessary to remove the flashlight batteries from the cabinet and connect two wires as instructed in the EXTERNAL BATTERY CONNECTION section on Page 18. It should be remembered that connection to a battery with the polarity reversed will cause the unit to be inoperative and may damage the transistors and other components.

A Heathkit Power Supply (Model XP-1) is also available that replaces the battery box in the XI-1 and powers the unit from standard 117 volt AC power. Refer to the Power Supply Specification Sheet for further information.

INTRODUCTION TO TRANSISTORS

Transistors have been one of the most important recent developments in the field of electronics. Although they have been available commercially for only a few years, they have already found application in every branch of the art. They can assume the duties of vacuum tubes in many applications, and in such capacity they are employed in the Model XI-1 Transistor Intercom.

Transistors possess many advantages over tubes. Probably the one most apparent is their extremely small size, making possible the miniaturization of equipment in which they are used. The Model XI-1 Transistor Intercom does not take full advantage of this fact, however, because of several reasons. First, the average kit constructor probably does not have the necessary facilities or experience to construct in confined spaces. Second, the size of the loudspeaker, and space requirements of the batteries limit the minimum size of the cabinet. Third,

miniaturization of all the components would only result in increased cost with no increase, and likely only a decrease, in the performance and economy of operation. Other advantages, however, make the use of transistors desirable as will be explained in the following paragraph.

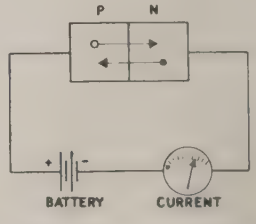
Because of their small size, transistors possess very little mass or inertia. As a result they are not subject to the shock, vibration and microphonic faults of tubes. Transistors do not contain a heater or filament, require no warmup; thus all power contributes to useful audio output. Because no heat is generated within the cabinet, longer life can be expected from other components subject to deterioration from heat. Transistors operate on very low potential or voltage, measured in volts rather than tens or hundreds of volts as with tubes. This makes battery operation very feasible and eliminates completely the shock hazard found in most tube equipment. Transistors have an extremely long life expectancy. Average life of transistors has not yet been definitely established simply due to lack of time to arrive at representative figures. Transistors have been in continuous operation for years without failure. Most failures are caused by improper use rather than by deficiencies in the basic design.

As with any good thing, there are also limitations to the capabilities of transistors. Primarily these limitations involve power handling capabilities, high frequency limitations and extreme temperature limitations. None of these limitations are approached in their application in the XI-1. One precaution must be observed, however. The batteries must be installed exactly as instructed or damage to the transistors may result. Also, it is good practice never to remove or insert a transistor with the unit turned ON.

Because of their application in the XI-1, it might be well to consider briefly the nature and construction of transistors.

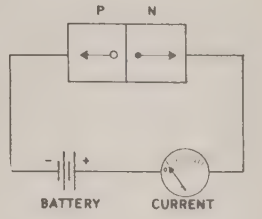
The material used in the fabrication of a transistor is a so-called semi-conductor. Germanium and silicon are two basic materials in common use today. All the transistors in the XI-1 are of the germanium type, although silicon transistors could be made to perform satisfactorily also. Stated simply, a transistor consists of a "sandwich" of various alloys of germanium. Three layers of the alloys form this sandwich. A connecting lead is attached to each of the layers and brought out for external connections.

It might be of interest to note here some of the production problems connected with the making of a transistor. The germanium must first be refined to an extremely high degree of purity. The rigid requirements would compare to allowing no more than one kernel of corn in several carloads of wheat. The pure germanium is then "doped" with precisely controlled amounts of other elements to obtain the proper alloy necessary for transistor action. More will be said later about the doping process. The center layer or "meat" of the sandwich may be only 1/1000 inch thick. This layer must be precisely located, and a wire attached. The entire process must be performed under "operating-room" clean conditions. Any contamination of the transistor may be cause for failure. The assembly is then hermetically sealed in a protective case, often with an inert compound to assist in conducting heat away from the assembly.



As mentioned before, the germanium must be doped to obtain the characteristics needed for transistor action. Different materials are used to produce a "P" or an "N" type germanium. "P" type germanium means that the pure metal has been modified so that there is an electron deficiency in the natural crystal structure, often referred to as a "hole". "N" type germanium means that an electron excess is created in the natural germanium crystal. Transistors are produced in both NPN and PNP configurations, the letters indicating the type of germanium in each of the layers. The reason for the two different types is that one may be better suited for a particular application than the other.

The middle layer of the sandwich is called the base. One outside layer is called the emitter and the other one the collector. The junctions formed between the emitter and base and between the collector and base have a characteristic similar to that of a diode rectifier in that the junction will conduct current much more readily in one direction than the other.



When voltage is applied across a junction with positive voltage applied to the "P" type region and negative voltage to the "N" type region, a current consisting of two components will flow. Electrons will flow from the "N" region across the junction to the "P" region and holes will flow or migrate from the "P" region across the junction to the "N" region. If the polarity of the applied voltage is reversed, the electrons and holes move away from the junction and for practical purposes, no current will flow. The drawings illustrate this effect.

In most applications, transistors have operating voltages applied so that the base-emitter junction is "biased" in the forward or conducting direction and the base-collector junction is "biased" in the reverse or non-conducting direction. When connected in this manner, most of the current carriers flowing in the emitter circuit will diffuse across the base region and appear as current in the collector circuit. Since the emitter bias is usually a very low voltage (being in the forward direction) and the collector bias is relatively high (being in the reverse direction), the transistor is able to produce a power gain. This can readily be seen when you consider that power is the product of voltage and current. Because the current flow is across a junction of very small area, the power handling capabilities of a transistor are limited due to heating caused by the current flowing through the junction resistance.

GLOSSARY OF RADIO TERMS

While by no means complete, this glossary should assist those who are not familiar with radio terminology. Further information may be obtained from texts available at most public libraries.

AC: ..... Alternating Current. An electrical current that reverses its direction of flow at regular intervals. House current makes 120 reversals every second. Two reversals are necessary to complete one cycle, hence 60 cycles. Much higher frequencies appear in radio circuitry, up to many millions of cycles per second.

AF: ..... Audio Frequency. Those frequencies that fall within the range of the human ear, approximately 20 to 20,000 cycles per second. Remember that the ear can only hear mechanical vibrations in the air, not electrical currents.

Amplifier: ..... A circuit designed to increase the strength or amplitude of weak signals. Ideally the output signal is an exact magnified reproduction of the input signal.

Ampere: ..... The unit of measurement of current flow. The number of electrons passing a point in one second.

Capacitor: ..... A component consisting of conducting plates separated by an insulating material. Various materials and construction are used in the capacitors in the XI-1. Deposited silver plates on ceramic for the disc capacitors, aluminum foil plates separated by a chemical oxide for the electrolytic capacitors. Capacitors are used to pass AC while blocking DC and also to tune or "resonate" electrical circuits to a desired frequency.

Conductor: ..... Any material that permits easy passage of an electrical current.

Current: ..... Generally the movement of electrons through a conductor. In vacuum tubes electron flow occurs in the vacuum. Movement of "holes" can constitute current flow in transistors.

DC: ..... Direct Current. An electrical current that flows in one direction only.

Diode: ..... A two element or two terminal device capable of passing an electrical current in one direction only. Used as a rectifier in the AC Power Pack, Model XP-1.

Farad: ..... A unit of capacity. Refers to the electrical size of a capacitor.

Frequency: ..... Repetition rate of an alternating current or of the vibration of the loudspeaker cone. Measured in cycles per second.

Ground: ..... An electrical connection to the earth. Also the reference point for signals and operating voltages in electronic equipment, usually the chassis.

μfd: ..... Microfarad, also abbreviated mfd. 1 microfarad equals .000001 farad.

$\mu\mu$f: ..... Micromicrofarad, also abbreviated mmf. 1 micromicrofarad equals .000001 microfarad.

Ω: ..... Ohm. The unit of electrical resistance.

Resistor: ..... A component designed to oppose the flow of current. The degree of opposition or resistance is measured in units called "ohms". Resistors are used to reduce current or voltage to a desired value, to provide isolation between circuits or to provide a load across which a useful signal may be developed. Resistors used in the XI-1 are made of a carbon compound housed in an insulating protective sleeve. Wires sealed in each end provide electrical connection to the resistance material.

Sensitivity: ..... A figure that expresses the signal strength required to produce a specified amount of sound from the loudspeaker.

Transformer: ... A component designed to couple AC signals or energy from one circuit to another. Construction can vary widely, depending on the application, but generally consists of insulated coils of wire wound on a common form of sheet iron for power or audio transformers. Transformers are employed for one or more of several reasons; they provide coupling of signals while isolating the DC operating voltages of the coupled circuits; they are capable of producing AC voltage "step-up" or "step-down"; they may be tuned to provide selective coupling of signals, as the case of IF transformers; they provide proper impedance matching between coupled circuits. The last application can be compared to the function of the transmission of your automobile. The transmission is designed to provide the most efficient match or coupling between the source of power (the engine) and the load (the rear wheel). In the XI-1, a good example of this application is the audio output transformer which provides the proper match or coupling between the source of power (the 2N1274 transistors), and the load (the loudspeaker).

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair are defective due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as illustrated in the Figures found in the SOLDERING TECHNIQUES section of this manual.

3. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial Diagram and as called out in the wiring instructions.
4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.
5. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram. NOTE: All voltage readings were taken with a 20,000 Ω per voltmeter. Voltages may vary 10% from the specified value, without causing trouble. Always make voltage readings with fresh batteries in the battery box.
6. A review of the CIRCUIT DESCRIPTION will prove helpful in indicating where to look for trouble.
7. If distortion and/or low output appear after the XI-1 has been in service and operating properly for some time, replace the batteries to make certain that the trouble is not due to low voltage.

SERVICE

If, after applying the information contained in this manual and your best efforts on the unit, you are still unable to obtain proper performance from the XI-1, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for the purpose of providing Heath customers with a personalized technical consultation service; this service is available to you without charge. The technical consultants are thoroughly familiar with all details of the instrument and can usually localize the trouble from a suitable description of the difficulty encountered. It is, of course, necessary that you provide full and complete information concerning your problem when writing to the Technical Consultation Department for assistance. For instance, clearly identify the kit involved, giving the purchase date and, if possible, the invoice number; describe in detail the difficulty that you have encountered; state what you have attempted to do to rectify the trouble, what results have been achieved, and include any information or clues that you feel could possibly be of value to the consultant who handles your problem. Failure to provide complete descriptive details may lead to incorrect assumptions on the part of the consultant and needless delay in the solution to your problem. Quite frequently, when the information given the consultants is complete, concise and reliable, a diagnosis of the difficulty can be made with confidence and specific instructions given for its correction. If replacement of a component is involved in the correction, the component will be shipped to you, subject to the terms and conditions of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. For a Master Station and up to 5 Remote Units, you will be charged a fixed fee of $4.00, plus the price of any additional parts or materials required. However, if the instrument is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase and give invoice number, if possible.

Local Service by Authorized Heathkit Dealers is also available and often will be your fastest, most efficient method of obtaining service for your Heathkits. Although you may find charges for local service somewhat higher than those listed in Heathkit manuals (for factory service), the amount of increase is usually offset by the transportation charges you will pay if you elect to return your kit to the Heath Company.

Heathkit dealers will honor the regular 90 day Heathkit Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company. It will be necessary that you verify the purchase date of your kit by presenting your copy of the Heath Company invoice to the authorized dealer involved.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if your local dealer assists you in locating a defective part (or parts) in your Heathkit, or installs a replacement part for you, he may charge you for this service.

Heathkits purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized Heathkit dealer in order to be eligible for parts replacement under the terms of the Warranty.

THESE SERVICE POLICIES APPLY ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

For information regarding modifications of Heathkits for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic outlet stores. Although the Heath Company welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder, according to information which will be much more readily available from some local source.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

If ordering a replacement transistor, use the replacement part number listed at the end of the Parts List. The color dot on the transistor ordered must be the same as that which it is replacing, therefore specify color code as well as part number when ordering.

SHIPPING INSTRUCTIONS

In the event that your Instrument must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE INSTRUMENT BEARING YOUR NAME, COMPLETE ADDRESS, INVOICE NUMBER ON WHICH THE INSTRUMENT WAS PURCHASED, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the Instrument in heavy paper, exercising care to prevent damage. Place the wrapped Instrument in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the Instrument and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Mich.

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit, if in HIS OPINION, the article is inadequately packed for shipment. Your Instrument will be returned by express collect.

SPECIFICATION CHANGES

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors-Capacitors		
1-1	1	47 Ω 1/2 watt resistor (yellow-violet-black)
1-4	1	330 Ω 1/2 watt resistor (orange-orange-brown)
1-6	1	470 Ω 1/2 watt resistor (yellow-violet-brown)
1-8	1	820 Ω 1/2 watt resistor (gray-red-brown)
1-14	1	3.3 KΩ 1/2 watt resistor (orange-orange-red)
1-16	2	4.7 KΩ 1/2 watt resistor (yellow-violet-red)
1-18	1	5.6 KΩ 1/2 watt resistor (green-blue-red)
1-25	1	47 KΩ 1/2 watt resistor (yellow-violet-orange)
1-44	1	2.2 KΩ 1/2 watt resistor (red-red-red)
1-69	1	18 KΩ 1/2 watt resistor (brown-gray-orange)
1-130	2	8.2 Ω 1/2 watt resistor (gray-red-gold-gold)
D21-47	1	.01 μfd disc capacitor
27-4	1	.2 μfd 50 V Mylar capacitor
D25-54	3	10 μfd 10 V electrolytic capacitor
25-88	2	50-50 μfd 12 V electrolytic capacitor
Transformers-Switches		
51-49	1	Input transformer
51-50	1	Driver transformer
51-51	1	Output transformer
60-10	5	DPTT 3-position slide switch
60-11	1	SPDT slide switch
62-11	1	3-position lever switch (spring return)
69-13	1	SPDT sensitive relay

PART No.	PARTS Per Kit	DESCRIPTION
Terminal Strips-Socket-Knobs		
B431-7	1	6-lug terminal strip (screw type)
431-45	2	6-lug terminal strip
434-102	2	Transistor socket
462-82	2	Knob
462-97	1	Knob (lever switch) top hat
Metal Parts		
100-M240-F287-317-318		
	1	Front panel assembly
200-M233	1	Chassis plate
202-M25	1	Chassis end, LH
202-M26	1	Chassis end, RH
204-M270	1	Terminal strip mounting bracket
204-M274	1	Speaker mounting bracket
214-M7	1	Battery housing
Hardware		
250-8	8	#6 x 3/8" Binder Head Sheet Metal screw
250-12	2	#6 x 5/8" Binder Head Sheet Metal screw
250-49	14	3-48 Binder Head Machine screw
250-56	11	6-32 x 1/4" Binder Head Machine screw
250-89	10	6-32 x 3/8" Binder Head Machine screw
252-1	10	3-48 x 3/16" nut
252-3	20	6-32 x 1/4" nut
252-15	14	4-40 x 3/16" nuts (separate bag)
252-22	2	6-32 speednut
252-38	2	Control nut (black finish)
253-22	2	Control spacer washer
253-27	1	#6 spacer washer
254-1	10	#6 lockwasher
254-7	10	#3 lockwasher
258-30	4	Battery contact spring
258-33	2	Battery holder spring
259-1	10	#6 solder lug
259-10	2	Control ground lug
260-26	2	Transistor heat sink clips
Miscellaneous		
B10-102	2	50 KΩ audio taper potentiometer
75-34	2	Phenolic punched board (battery box)
92-10	1	Cabinet shell (moulded plastic)
92-12	1	Cabinet top (moulded plastic)
117-2	1	Set of four transistors (packaged)
340-2	1	Length #20 bare wire
344-1	1	Length hookup wire
346-1	1	Length insulated sleeving
390-83	1	Adhesive label (BATTERY BOX and TERMINAL INDICATION)
391-8	1	"H" decal
401-30	1	Speaker, 4 1/2" permanent magnet 45 Ω voice coil
595-284	1	Manual
For Replacement ONLY:		
417-21		2N1274 transistor - specify color dot

3-48 Binder Head Machine Screw

#3 Lockwasher

4-40 nut

3-48 Nut

6-32 x 1/4" Binder Head Machine Screw

#6 Lockwasher

#6 spacer washer

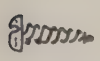
6-32 Nut

6-32 x 3/8" Binder Head Machine Screw

#6 Solder Lug

Control spacer washer

Control Nut



#6 x 5/8" Binder Head Sheet Metal Screw

#6 x 3/8" Binder Head Sheet Metal Screw

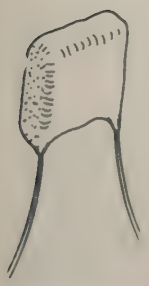
10 μfd 10 V electrolytic capacitor

1/2 watt Resistor

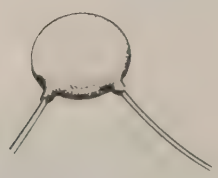
Speednut

Battery Holder Spring

Battery Contact Spring

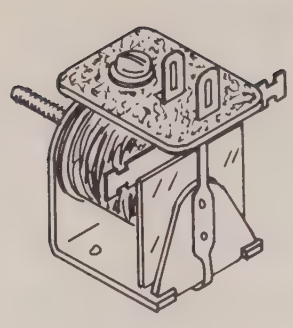


Mylar capacitor

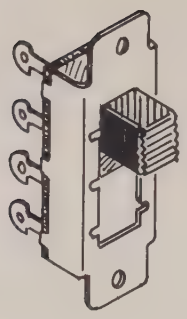


Disc ceramic capacitor

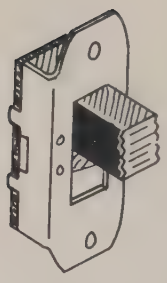
Transistor Heat Sink Clip



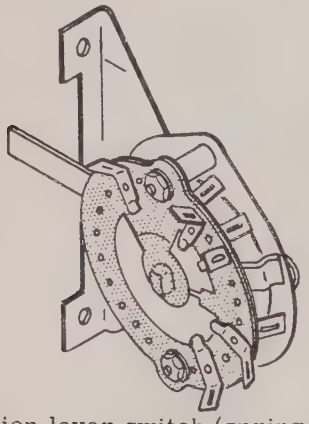
SPDT Sensitive Relay



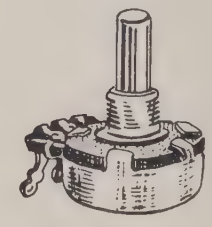
3-position Slide Switch



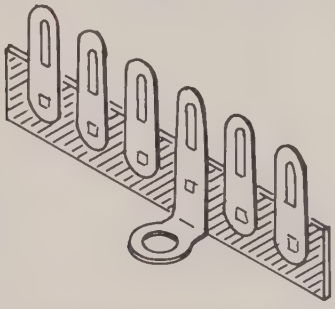
SPDT Slide Switch



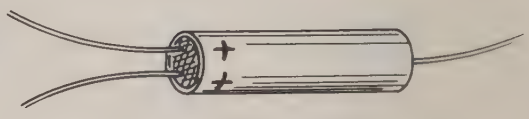
3-Position lever switch (spring return)



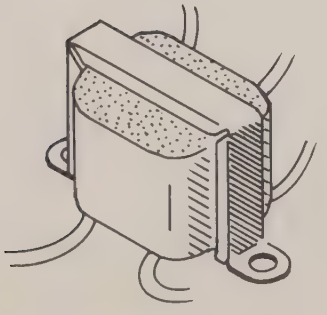
50 KΩ audio taper potentiometer



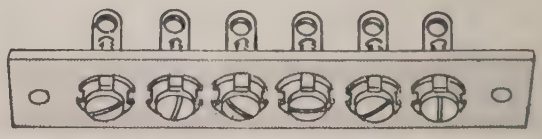
6-lug Terminal Strip



50-50 μfd 12 V electrolytic capacitor



Transformer



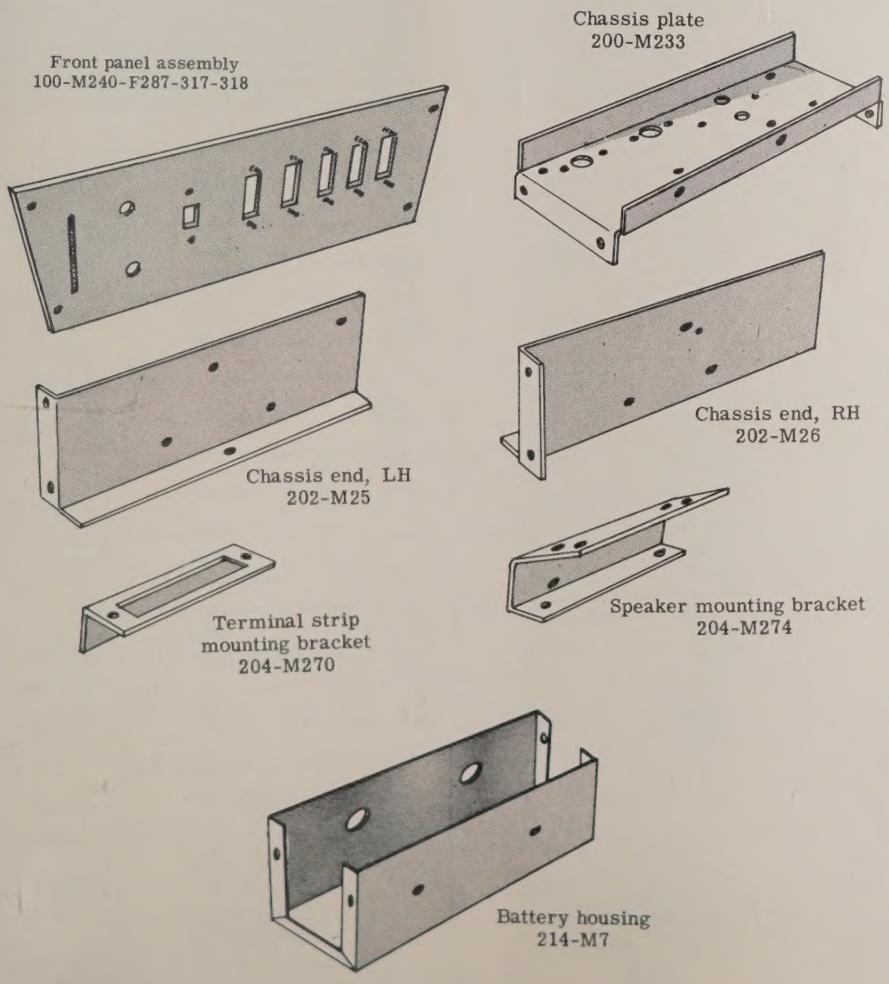
6-lug Screw Type Terminal Strip

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY



HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

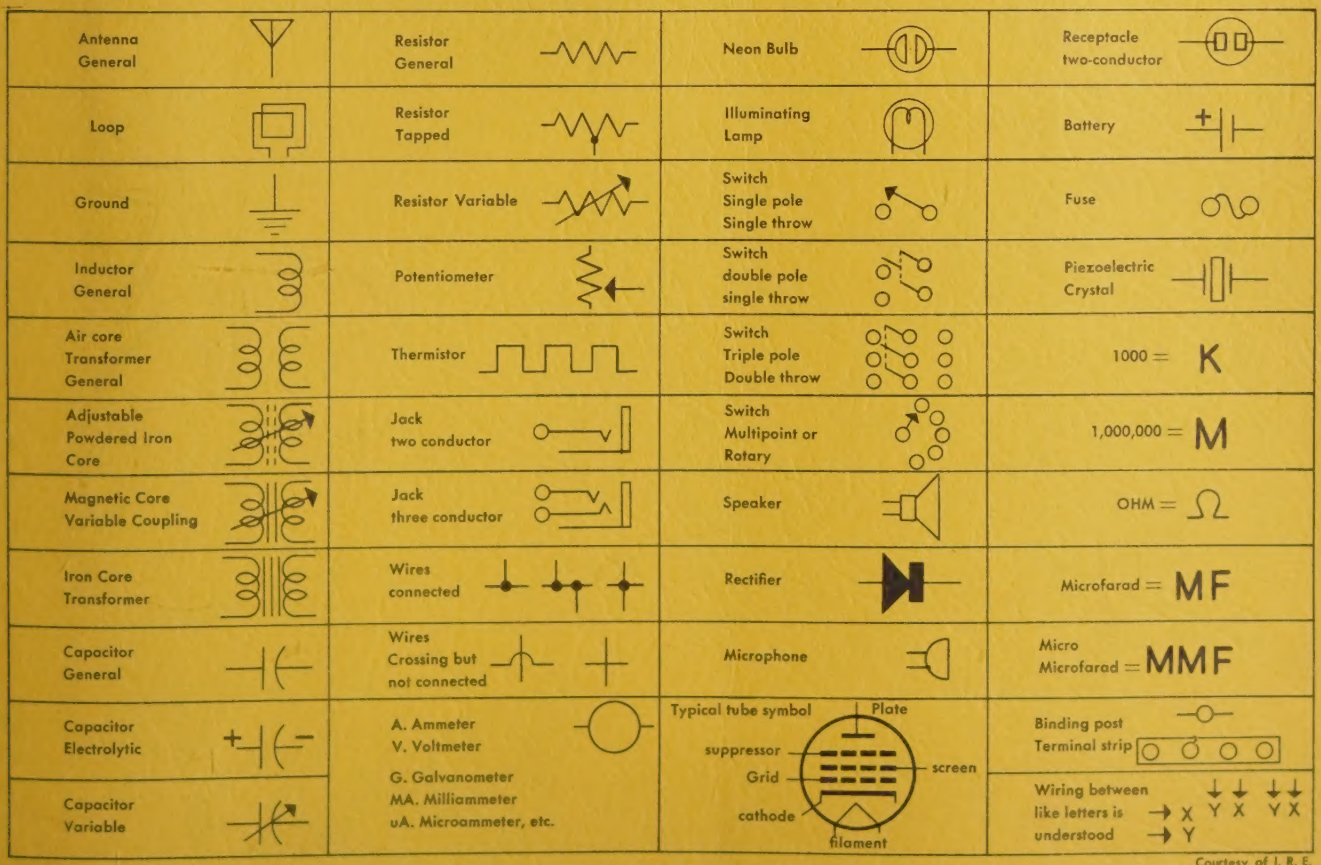
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



Courtesy of I. R. E.

HEATH COMPANY

A Subsidiary of Daystrom Inc.

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

BENTON HARBOR, MICHIGAN

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MA24250